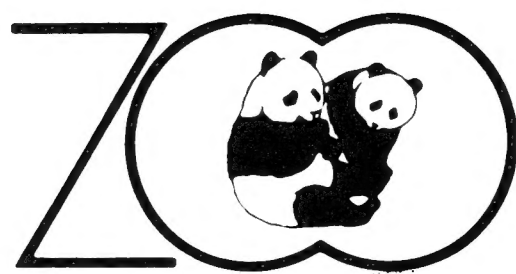


ZOOGOER

May-June 1988



**Friends
of the
National**



is a nonprofit organization of individuals, families, and organizations who are interested in helping to maintain the status of the National Zoological Park as one of the world's great zoos, to foster its use for education, research, and recreation, to increase and improve its facilities and collections, and to advance the welfare of its animals.

ZooGoer [ISSN 0163-416X] is published six times a year by Friends of the National Zoo to promote its aims and programs, and to provide information about FONZ activities to its members, volunteers, and others interested in the purposes of FONZ. The nonmember subscription rate is \$10 a year. Third class mailing permit no. 6282. Copyright 1988, Friends of the National Zoo, National Zoological Park, Washington, D.C. 20008. All rights reserved.

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Cover: *Preservation of wetlands, which sustain a range of bird life including these roseate spoonbills, (Ajaia ajaja) is a conservation priority. Photo by Jessie Cohen.*

CALL FOR NOMINATIONS

In accord with Article II of our bylaws, the FONZ Board of Directors is hereby soliciting nominations from the membership.

Board Responsibilities

As members of a "working" Board, FONZ Directors "administer and manage" the affairs of the Friends of the National Zoo. The Board of Directors establishes the policies of the corporation, approves budgets and expenditures, and otherwise directs the activities of FONZ officers and employees. Much of the Board's work is accomplished through active committees.

The *Administration Committee* establishes and supervises administrative policies and procedures for FONZ employees.

The *Education Committee* participates in development of FONZ-supported education programs and supervises educational activities and NFP research grants authorized by the Board.

The *Finance Committee* institutes, develops, and supervises fiscal operations.

The *Membership Committee* is responsible for recruiting new members to FONZ and for developing membership activities.

The *ZooFari Committee* carries out fundraising for the Theodore H. Reed Animal Acquisition Fund and conducts an annual ZooFari benefit gala.

The *Visitor Services Committee* oversees management and operation of FONZ gift shops, food, parking, and other visitor service facilities at the Zoo.

All Board members serve on at least two committees, and attend two or more FONZ meetings each month. They serve on a voluntary basis without pay.

The criteria by which potential candidates are judged for nomination to the Board of Directors are: the candidate's strong interest in supporting zoological education, research, and conservation in accordance with the purposes of our corporation; leadership; experience or skills that are needed and would directly benefit the management and operations of FONZ; and willingness and time to participate fully in FONZ work and activities. Candidates must be dues-paying members of FONZ.

Nomination Procedures

Nominations may be made only by dues-paying family, couple, or individual members in good standing. (Senior citizen, contributing, and patron members of FONZ and members who previously joined the corporation as life members are entitled to all rights and privileges of dues-paying family, couple, or individual members.) Employees of FONZ or the National Zoo are not eligible for membership on the FONZ Board of Directors.

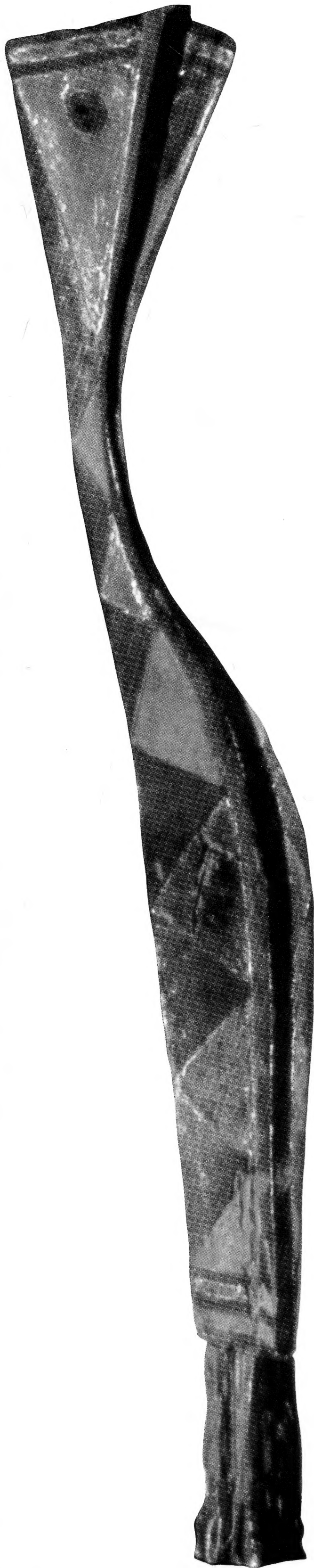
Nominations must be submitted on an official FONZ nomination form with a biographical sketch of the nominee attached. Nomination forms can be obtained at the FONZ office or will be mailed on request. For information or forms, call 673-4950. Deadline for submitting nomination forms and accompanying biographical sketches is June 21, 1988. Address submissions to: James Rogers, Chairperson, FONZ Nominating Committee, National Zoological Park, Washington, D.C. 20008.

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The Only Game in the Forest

If you want to see great predators the next time you visit the Zoo, consider Homo sapiens strolling along the path. In areas remote from cities and commerce, people still hunt and eat an astonishing number and variety of wild animals, demonstrating that humans are as predatory as jaguars or wolves.

Kent H. Redford



For many people in the world, game, or meat from wild animals, provides much of the protein they need to survive. A recent survey revealed that wildlife and fish supply 50 percent or more of the animal protein consumed daily per capita in 19 countries, and in another 43 countries game and fish contribute at least 20 percent of the animal protein in the daily diets of the inhabitants.

In remote areas where people have access to wildlife and little opportunity to earn cash to buy commercial foods or livestock, game is even more important as a source of animal protein. In the densely forested Ucayli region of Amazonian Peru, for example, investigators estimate that wildlife provides as much as 85 percent of the animal protein consumed in rural areas. Typically, an Amazonian Indian consumes less than two ounces of protein per day, with most of this meager ration coming from game.

I became interested in studying subsistence hunting in the Neotropics because of its overwhelming, and vastly underappreciated, importance as a factor in animal conservation. The newspaper stories we read are of rhinos killed for their horns, bears for their paws, musk deer for their musk, and tigers for their skins. But probably the majority of animals killed by humans are destined for the pot rather than the marketplace. Humans and their game coexisted in Neotropical forests for thousands of years, and for thousands of years this game has been an essential part of human diets. Both the humans and their game are now threatened by

the massive destruction of Neotropical forests. Thus we need to understand more about the dynamics of subsistence hunting, not only to learn more about the conservation of animals, but also to help ensure the continued well-being of the hunters and their families.

In our culture, hunting is primarily for sport; it is heavily controlled and focuses on a few species such as white-tailed deer and wild turkey. This is a far cry from subsistence hunting in the tropics, as ecologist John Robinson and I learned from our survey of the hunting patterns of some of the principal game-hunting groups in tropical Latin America. In general, these groups of subsistence hunters take an impressive quantity and variety of game. The hunters fall into two categories. The first includes the hundreds of groups of indigenous people who have inhabited the forests for thousands of years. They display a wide range of languages and customs, although all are united in their reliance on the rainforests as sources of housing material, food, and medicine. The second category is composed of "colonists" whose ancestors arrived relatively recently to seek their livelihood on the "frontiers" of the rainforests. Colonists are by and large subsistence farmers who cut a few acres of forest every several years to plant a garden. Some of these families have inhabited the rainforest for hundreds of years, earning a living by extracting rubber or selling animal skins; others arrived only in recent decades, attracted by the prospect of free land. A comparison of Indians and colonists illustrates some

of the effects of culture, environment, and technology on hunting practices.

Collectively Indians and colonists take an astonishing assortment of game—all available species of vertebrates are consumed by one group of humans or another. (We ignored the contribution of fish and invertebrates, such as termites, which are widely consumed throughout the rainforest.) The Maraca Indians, who inhabit the forest mosaic of the foothills in Columbia, take a staggering 51 species of birds, including 10 species of hummingbirds. In general, however, the hunters in the 22 groups we surveyed take mammals more often than birds or reptiles. With each of these classes of animals, a few species provide most of the meat eaten by the hunters and their families.

The quantity of animals taken by these hunters over a year's time is also impressive. One group of about 800 Waorani Indians, a relatively isolated tribe in Ecuador, took 730 large woolly monkeys in a year. Using silent blowguns and poison darts, these hunters can kill a large number of monkeys before the troop is alarmed and flees. Overall, the Waorani took 58 species of animals totaling 3,165 individuals, including 313 toucans. Colonists in Mato Grosso, Brazil took 1,014 white-lipped peccary in one year. This large, pig-like animal forms herds of up to 200 indi-

Wild game provides an essential supplement of protein for Amazonian Indians like this Kayapo family. (Photo by Kent H. Redford)



viduals and is the preferred game species wherever it occurs.

Indians and colonists take many of the same species, but Indians generally take a much wider variety of game than the colonists. While the majority of their prey is mammals—about 55 percent, birds also account for a significant 35 percent share. The mammals they hunt range from coatis to anteaters to tapirs, the largest animals in the rainforest. The mammals they hunt most often, however, are capuchin monkeys (also known as organ-grinder monkeys), pacas, 20-pound spotted rodents, and collared peccaries, or javelina.

Their choice in birds is equally catholic, including macaws, toucans, curassows, and hummingbirds. The most commonly taken reptiles are two species of tortoise and various species of caiman. Tortoises are particularly favored because, in a land with no refrigeration to prevent spoilage, they can be kept alive for months with little or no food before they are eaten.

The colonists take a narrower range of species and clearly prefer to hunt mammals, which account for nearly 70 percent of the animals they take. In the main, colonists hunt paca, agoutis, acouchis, the two species of peccary,

and deer. The colonists also take fewer individual animals overall. Why is this so?

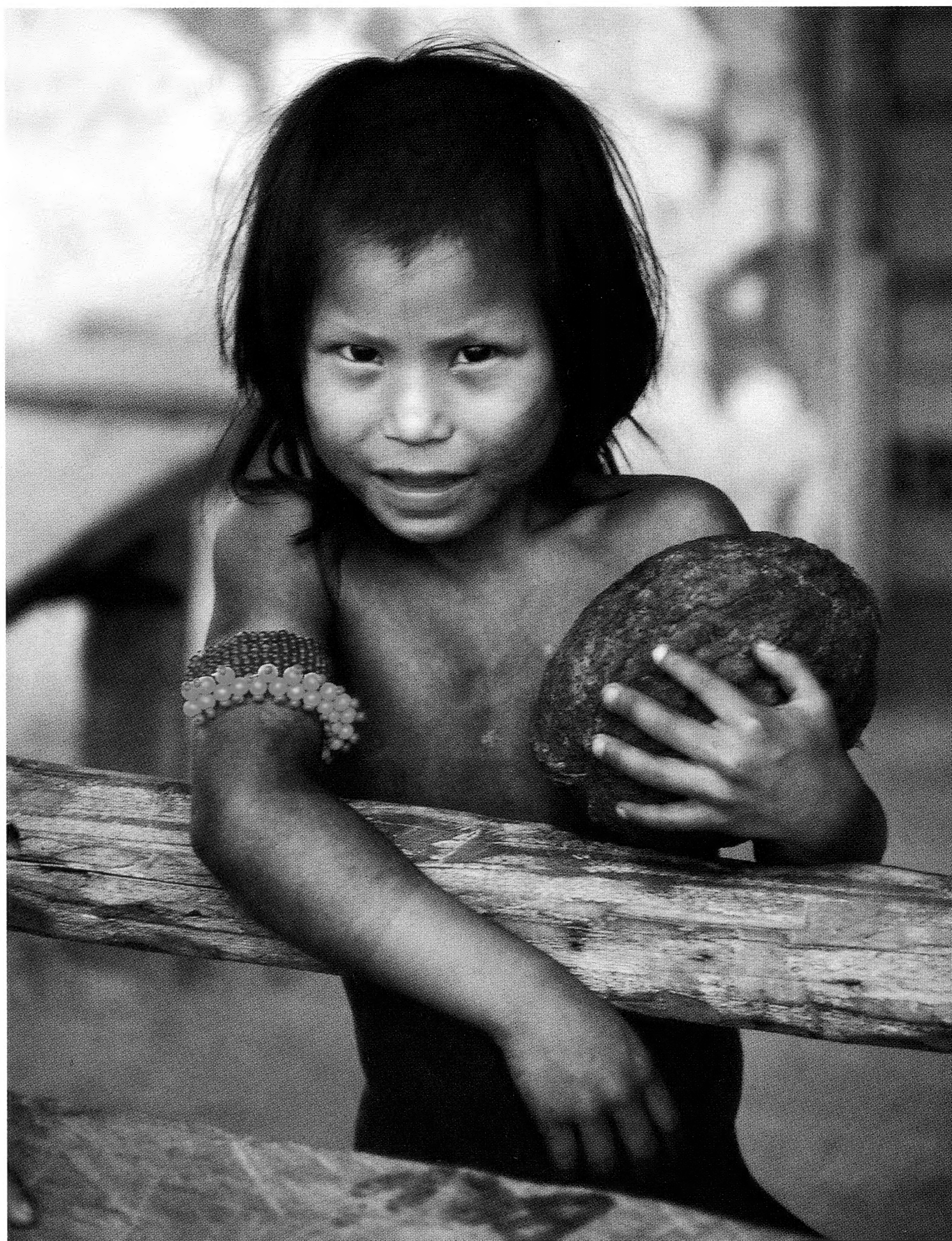
The colonists have greater access to commercial markets than do the Indians, so they are less dependent on game as a food source. Whenever they have cash they prefer to buy canned meat and livestock. In some cases this is due to the cultural stereotype that “civilized people” do not eat game. Colonists also have a tradition of raising domestic animals such as chickens for meat.

The Indians, moreover, have greater access to game. Not only are their patterns of settlement and agriculture less damaging to the forest around them but may actually have developed in part to ensure a continuous supply of game.

Although settlement patterns are changing as the land available to the Indians shrinks, traditionally Indians have constructed small villages of palm thatch huts and occupied them for only a few years. Over time, large species of game, such as peccaries and tapir, become increasingly rare near these villages, and the remaining species are smaller, such as rodents and birds. Thus the age of a village affects the type of game available. By moving every 5-10 years to another part of the forest, the Indians compensate for the overhunting of desired species in the areas near their settlements. Although they may return to the same settlement sites over a 50-year cycle, intensively hunting a region only periodically allows the wildlife to recover its numbers.

Another strategy the Indians may use to ensure a good supply of wildlife near their settlements is to plant gardens that feed wildlife as well as people. By cultivating an abundance of plants that appeal to both humans and game animals, such as peach palm and manioc, a staple food item from which tapioca is made, and then leaving the gardens unfenced, the Indians provide garden products for themselves and create a magnet for many species of game. The Machiguenga Indians, who inhabit the forests on the Peru-Columbia border, grow more than twice as much manioc as they eat and refer to abandoned gardens as “belongs to peccary.”

By attracting animals, these gardens continue to yield valuable products long after cultivation has ceased. Palm trees in “abandoned” gardens will bear fruit for many years, drawing many



Local extinctions of wild game may change the traditional way of life for this child of the Amazon. (Photo by Kent H. Redford)

species of fruit-eating birds, while mammals such as deer, tapir, and collared peccary may find a greater abundance of edible leaves and fruits in these modified areas of the forest. Such "game gardens" yield the Indians a rich harvest on their periodic hunting trips to these areas.

The agricultural patterns and permanent settlements of the colonists, on the other hand, may often lead to over-hunting of the game. The larger species are the first to go, causing the colonists to rely increasingly on smaller animals. This was apparent in one study that showed rodents comprising only three percent by weight of all game taken in three-to-five year old settlements of colonists, while in 15-year-old settlements rodents accounted for 39 percent of all game taken. Local extinctions of species thus affect both the variety and the amount of game taken over time.

Differences in agricultural techniques between the Indians and the colonists may also affect the presence of game. Colonists tend to plant fewer crops less densely; providing less food and less cover, these gardens are less attractive to animals.

Part of the explanation for the difference in the variety of animals hunted by Indians and colonists may lie in strong taboos against certain kinds of game. Contrary to the popular notion of a taboo as an exclusively Indian concept, food taboos appear to exert a powerful influence on the hunting of the colonists. Colonists tend to take game that resembles more familiar, often domestic, species of mammals and birds, the chief exception being the long-nosed armadillo. The peccaries, for instance, are very similar to both pigs and Old World boar. And colonists won't even consider eating sloths or toucans, which are often eaten by Indians. On the other hand, deer meat, preferred by the colonists (and many other of the world's hunters), is frequently tabooed by Indian groups.

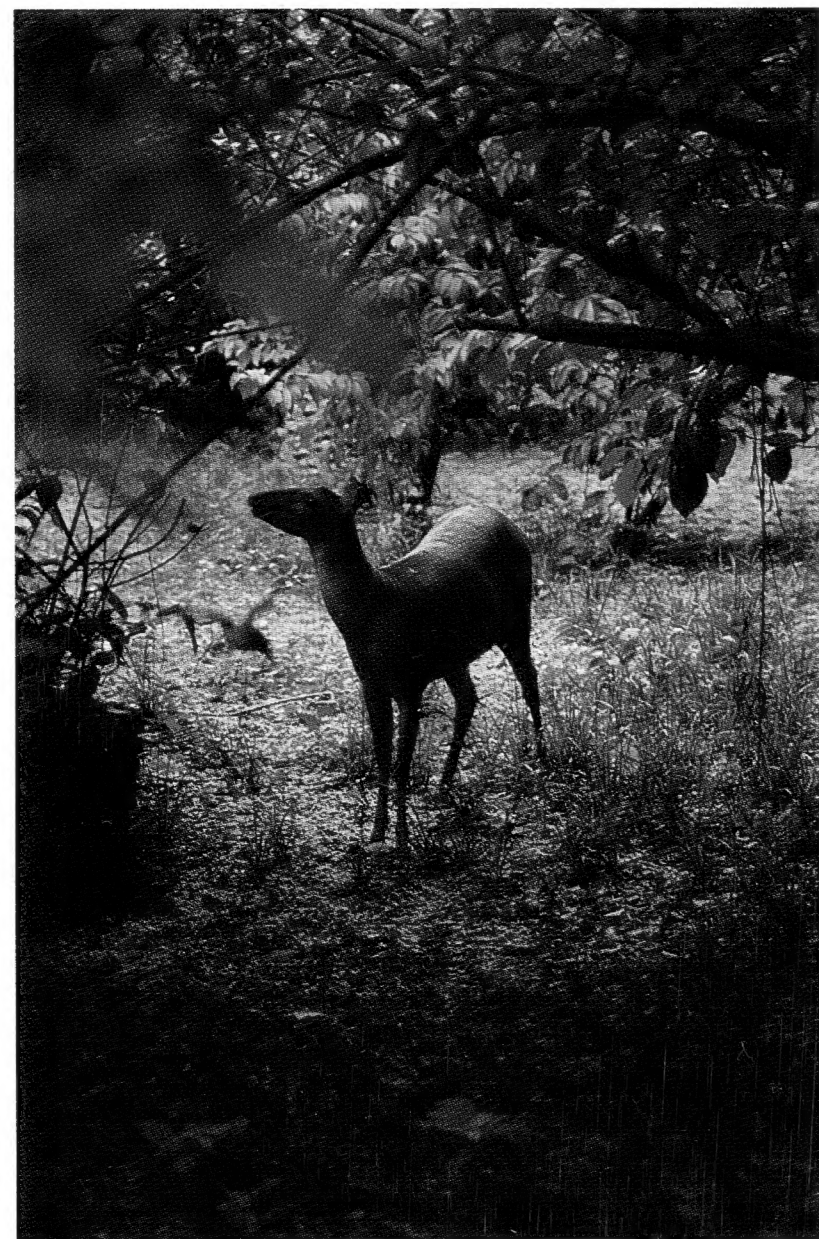
The colonists and Indians also hunt differently. The colonists rely mainly on guns for hunting, while in some areas Indians still hunt with bows and arrows and blowguns, although most now use shotguns. However, scarce cash must be used to purchase the weapon and ammunition, whereas no cash is required to hunt with weapons made of forest materials. For example, a blowgun is made from palm wood and darts are manufactured from palm slivers and kapok and poisoned with

tree sap. As a result, bow and blowgun hunters take many smaller animals that would not be economically feasible to hunt with firearms. While a Waorani, for instance, can make a blowgun dart in less than five minutes, a single shotgun shell would cost him the equivalent of three hours strenuous labor in the garden of a neighboring colonist. Thus, the Waorani save their shotguns for larger game and use blowguns to take great numbers of toucans, aracarís, and squirrels. Blowgun hunters also focus on these small, arboreal species because the accuracy of this weapon, which may reach 10 feet in length, is greater when it is held vertically.

Although they take longer to make than darts, arrows serve a similar purpose for Indian groups that do not use blowguns. Even though many of the Chimane Indians, who inhabit the banks of Bolivian Amazonia, have shotguns, they cannot usually afford shells, and therefore hunt primarily with bows and arrows. Indians also use machetes, dogs, and even their bare hands to procure game. In fact, some Siriono Indians in the last remaining village of this tribe do not own firearms and have never learned to hunt with a bow; instead, they have become specialists at hunting collared peccaries and paca with dogs and machetes.

Unaccustomed to these hunting methods, colonists can do little without the cash to purchase ammunition for their guns. For them, no ammunition generally means no meat. In one of our surveys, all of the colonists possessed firearms but only 40 percent had ammunition. Inevitably this affects the amount of game they eat and thus, their overall health.

With the old methods, Indians have fed themselves for thousands of years. But traditions are changing. The size and extent of Indian lands have been diminishing since the first Europeans arrived and the pattern of small, mobile villages has changed. Now villages frequently contain hundreds of people and do not relocate because they have been founded near trading posts, missionary outposts, or schools. Finally, Indians are often involved in a market economy. The hunters of the rainforest can earn cash from the market in animal products, not only for food, but for hides and furs and exotic live animals that thrill the consumers of the industrial world. With the money to purchase new technology, the hunters can more fully exploit previously hunted species:



Deer, like this small South American red brocket (Mazama americana), are taboo as food to some Indian hunters. (Photo by Kent H. Redford)

Shotguns make it easier to kill many peccaries in a herd and headlamps greatly facilitate hunting for nocturnal species like pacas. Yet with less and less land available, the pressure on wildlife intensifies. In many parts of the Amazon, the market for animal products has already caused local extinctions of species like the giant river otter for its pelt and the river turtle for its eggs and meat.

Such local extinctions inevitably alter the ecology of an environment, but their effects pale in the face of the broad-scale destruction of habitats threatening all species that live in the rainforest. We all know that habitat destruction is responsible for endangering many of the world's great predators. The tigers of Asia and the jaguars of the Amazon are both examples of animals in the National Zoo's collection whose existence relies on the rainforest and its abundant wildlife. When the rainforest has given way everywhere to poor pastures, there will be no more tigers, no more jaguars, and no more food for the millions of people who also rely on the rainforest for food and call it home. □

Kent H. Redford is a scientist at the University of Florida's Center for Latin American Studies.

A Honey of a Bear

Susan Weinberg

A pair of shaggy paws flipped the log effortlessly, then tore into its bark with rapier claws. A rubbery snout combed the log's every crevice, searching for a way to the honey at its center. Within minutes, the bear had stripped the log of bark and begun to shred the wood beneath. Two hours later, he reached the honey-filled core and then continued his assault on the log into the evening. By dawn, every drop of honey was gone, and the exhausted bear lay in a deep sleep. Designed by National Zoo staff, fabricated honey logs like this one provide a natural outlet for the sloth bear's energy and also allow visitors to observe the animal's unique feeding behavior.

Like most bear species, sloth bears

are drawn to honey, however these bears are primarily adapted to a staple diet of ants and termites. A native of India and Sri Lanka, the sloth bear (*Melursus ursinus*) is known for its mobile "vacuum cleaner" snout which aids its pursuit of hidden insects. Ready to feed, the animal rips open a termite mound with its long, curved claws and flexes its protrusible lips. Closing its nostrils against the dust, the bear blows loose dirt from the exposed insects, then sucks them up the tube and through a gap in its unusually small front teeth. The noisy blowing and sucking sounds which accompany this process can be heard hundreds of feet away.

Although the sloth bear also feeds on fruit, flowers, and grass, this prefer-

ence for ants and termites is central to its lifestyle. Joining the ranks of other ant-eating mammals, called myrmecophages, such as echidnas, anteaters, and pangolins, the sloth bear exploits this resource so completely that it stands alone among the bears. The eight species of ursids are distributed through a wide range of habitats, and the sloth bear's departure from more usual bear diets reflects the species' efficient adaptation to its niche: Whereas carrion is an important food source for bears in cooler climates, sloth bears ignore freshly killed animals, which would either rot in the tropical heat or be gulped down by potentially dangerous competitors.

A solitary resident of the forest, the sloth bear is a persistent tree climber when in search of food and travels widely in pursuit of seasonally available fruits. This complicates efforts to protect the species because few national parks or reserves are large enough to contain their extensive annual ranges.

Females withdraw to dens in early autumn, producing small litters of one to three cubs, which remain with the mother for at least two years. When traveling, the cubs ride crosswise on their mother's back. This trait is unique among bears, and its evolution may be related to the sloth bear's specialized feeding behavior—other myrmecophages, such as anteaters, also carry their young this way. In addition, pressure from arboreal predators like leopards may drive cubs to seek protection on their mother's back rather than up a tree.

Marked with a yoke of white or yellow fur, the sloth bear can grow to almost six feet in length. The shaggy black coat is longest between the shoulders, giving the animal a somewhat droopy look. Its gray muzzle is naked, an adaptation that may keep muzzle hair from becoming gummy with termites' defensive secretions.

While certain of its features and behaviors are reminiscent of the termite-eating aardwolf, when the sloth bear



Long snout and extendible lips of a sloth bear. (Photo by Jessie Cohen, NZP Graphics)



The sloth bear uses its impressive claws to tear open termite mounds. (Photo by Jessie Cohen, NZP Graphics)

was first described by European biologists it was confused with the New World sloths. Named in 1791 *Bradyptes ursinus* (*Bradyptes* is the genus name of the two-toed sloth), the animal was renamed *Melursus ursinus* just two years later, in recognition of its obvious link to the ursids. Despite the lazy images its name evokes, the normally peaceful animal tends to panic when taken by surprise. Instead of retreating up a tree in typical bear fashion, the sloth bear crashes through tangled underbrush to avoid encounters. This is probably an evolved response to the elephants and leopards that share the bear's haunts; if

enraged, either could probably extract a snarling sloth bear from a tree.

Thought to cause damage to crops as well as people, the sloth bear has been hunted extensively. Over-killing, combined with human encroachment on its natural habitat, has decimated sloth bear numbers in recent years. The species' slow reproductive rate—litter sizes averaging only 1.5 cubs, the long period of time cubs spend with mother, and the late reproductive age of six—makes the bears extremely vulnerable to these hunting and habitat pressures. Today, this rare species is protected by law, but its status is uncer-

tain and only careful management will ensure the animal's survival.

This spring, National Zoo staff brought a young female sloth bear from India's Sri Chamarajendra Zoological Gardens in Mysore to the National Zoo. Following careful introductions to the Zoo's male, she will be on exhibit in June, and hopes run high for sloth bear cubs in the future. The female brings new genetic material to the North American breeding population of sloth bears, and the breeding project will yield valuable research data and increased public support—essential elements of any zoo conservation program. □

Elegant Waders

Austin L. Hughes

In a salt marsh, just after dawn, a long-legged grayish bird stands perfectly still in shallow water. Its long neck is held straight up, its bill level. Even though it may remain in this position





for an hour or more, the great blue heron is not resting but carefully scanning the water for potential prey. Now and then, it lowers its snakelike neck and with a sudden, stabbing motion, plunges its bill into the water and captures a small fish. Raising its neck and throwing its head back, the heron swallows the fish whole.

People frequently confuse large herons and cranes, but in fact these birds are not closely related. Both cranes and large herons like the great blue are long-legged birds, and both are often found near water. But cranes generally feed in upland areas on insects and other small animals, while most herons feed only

in shallow water. Typically, a heron will spend long hours waiting on the shore or in the shallows for fish to approach; at times it may also stalk its prey through the water, carefully lifting and lowering its feet to minimize ripples. Along with frogs and aquatic invertebrates, fish are the dietary mainstay of most herons. Occasionally, however, herons will capture flying insects, even leaping out of the water to catch them on the wing.

Ciconiiformes

The 60 species of herons and bitterns, along with about 50 species of storks, ibises, spoonbills, and hammerheads, belong to an order of birds called Ciconiiformes (meaning "stork-like"). Members of this order are found in wetlands habitats throughout the world. Some ornithologists place the four species of flamingos, which are widely distributed in tropical and warm temperate waters, in this order as well. But the relationship of flamingos to other birds has long been a subject of debate, due in part to the flamin-

go's unique method of filter-feeding. While some have grouped flamingos with ducks and geese rather than the Ciconiiformes, other experts have placed the flamingos in an order of their own.

Related or not, all of these wading birds have their own ways of exploiting the abundant animal life found in wetlands and coastal areas. Herons have straight, sharp bills, which are particularly effective in catching small fish and other fast-moving aquatic prey; storks' bills are similarly shaped but broader and their diets typically include less fish. The unusual marabou storks feed mainly on carrion and, like vultures, their heads are bare of feathers. The hammerhead has a pointed, heron-like bill and gets its name from the backward-pointing crest that gives its head a hammer-like shape.

Ibises have long, curved bills that taper to a narrow tip, which is used to probe for small organisms buried just below the surface in mud or sand. The closely related spoonbills have a remarkably different bill shape: As the

Left: A large, untidy stick nest can barely contain these great blue heron (Ardea herodias) fledglings. (Photo by Jessie Cohen)

Above: Blue Crane or Heron. (John James AUDUBON; National Gallery of Art, Washington; Gift of Mrs. Walter B. James)

name suggests, both halves of the bill are widened near the tip just like spoons. The bird does not use the bill as a spoon to scoop up food, however, but rather holds the tip just beneath the surface of shallow water and moves it rapidly from side to side, stirring up aquatic invertebrates. The spoon-shaped projections at the end of the bill extend its reach and enable the bird to capture fast-moving prey like small shrimp. Despite their ungainly bills, these birds are graceful in the air: The sight of a flock of pale pink roseate spoonbills in flight is an unforgettable experience.

Many Ciconiiformes share the habit of nesting in colonies, which may range in size from a handful of pairs to many thousands, depending on the species and location. Colony nesting is relatively rare among birds. In many bird species, each nesting male defends a territory during the breeding season. The nest is on the territory, and all or most food given to the nestlings is gathered on the territory. Indeed, the bird songs we take as a sign of spring are actually territorial advertisements, by which one breeding male warns others to stay away.

The situation is very different in a "heronry," where trees may be filled with any number of large, untidy stick nests spaced only a few feet apart. A bird sitting on one nest may squawk when a neighbor coming in for a landing passes too close, but otherwise nesting pairs tolerate each other. No pair defends a separate feeding area, but rather adult birds search and feed together in flocks.

Observations on herons and other colonial nesters suggest that nesting colonies serve as "information centers." According to this theory, colonial nesters benefit from the presence of other birds because each bird can learn from others the location of good feeding sites. Such information is particularly important for wading birds. In springtime, when the birds are nesting, water levels may change dramatically due to flooding, so that the best places to search for food may change from day to day. If one bird happens upon a bonanza, such as an aggregation of breeding frogs or small fishes, others can follow and exploit the same resource.

By day, a heronry is a hub of activity. Birds are leaving for feeding grounds or returning, and as they do so they communicate with their mates by means of characteristic displays. For

Of Wetlands, Waterfowl, and Wading Birds



Male mandarin ducks (above) and wood ducks (right) with their distinctive plumage will be just a few of the many stars in the Zoo's new wetlands exhibit. (Photos by Dorothy Andrade and Jessie Cohen, NZP Graphics)

Ponds, bogs, swamps, marshes, estuaries, and prairie potholes. What do they have in common? All provide a watery "stage" for the complex, intricate interplay of a large cast of plants, insects and other invertebrates, reptiles, amphibians, birds, and mammals. All are wetlands and include some of the most important wildlife habitats in the world.

Although the animal life appears at first glance to star, grasses and other types of aquatic vegetation actually play the leading roles. The grasses teem with snails, small crustaceans, insects, and frogs, all of which shelter and nest in the vegetation. For other species—marsh insects, fish, ducks, and muskrats—rich wetlands vegetation provides both shelter and a complete diet. And these species, in turn, are food for animals higher up in the food chain. Fish, for instance, comprise a major part of the diet of several species of waterfowl, such as mergansers, of wading birds, such as herons and egrets, and of our national bird, the

bald eagle.

The National Zoo is now putting the finishing touches on its own wetlands exhibit, which will give visitors a naturalistic view of life in these complex habitats. The stars in the cast will include a remarkable range of birds that are adapted to—and dependent on—wetlands. Amid cattails and grasses, wild rice and water lilies, visitors will be able to see some of these birds in action.

Eurasian wigeons, Northern shovelers, green-winged teals, and common gadwall will represent the surface-feeding, or dabbling, ducks. Dabblers have broad, flat bills especially well-suited for feeding on the small crustaceans and vegetation that occur within a neck's reach under the water's surface. In contrast, diving ducks, as their name implies, feed mainly underwater. Smew (a Eurasian duck rarely seen in zoo collections), canvasbacks, hooded merganser, and American merganser, to name a few diving ducks in the new exhibit, feed on fish, mussels, insects, crustaceans, and submerged vegetation. The diving ducks' feet are set farther back on their bodies than those of dabblers, giving them better propulsion when they dive for food. The bills of some divers are also equipped with serrated edges for catching fish and tearing them apart.

Visitors will also be able to watch a variety of the ritualized courtship displays that are unique to each species of duck. For instance, the striking plumages of male mandarin and wood ducks are only fully appreciated when the males are courting the more drably costumed females of their species. Courting stiff-tailed ruddy ducks spend hours in a distinctive strutting and "bubbling" display, sure to be a hit with visitors. The male struts through the water with his tail almost touching his head, while he slaps his blue bill against his wet, inflated chest to produce a froth of bubbles.

As the exhibit develops, the cast of

birds will continue to grow. Many species of migratory waterfowl and waders will be introduced into the new wetlands, which will also undoubtedly be used by native migrating birds.

Wetlands are critically important to migratory birds; in fact, annual movements are tied to the distribution of wetlands habitats. Migratory ducks, geese, swans, and herons follow specific—and ancient—flyways that evolved in association with the occurrence of wetlands. In the United States, for instance, four major flyways exist. The Atlantic flyway extends along 7000 miles of coastline, featuring bays, sounds, river estuaries, and low-lying marshes and swamps, from Maine to the tip of Florida. The nearby Chesapeake Bay is a major stopping point along this flyway. The Mississippi flyway forms a Y-shape, with birds from the Mackenzie Delta and Alaska in the west and Hudson Bay and Baffin Island in the east converging on the states bordering the Mississippi River. These states contain more than half of the wetlands acreage in the entire United States classified as being of significant value to waterfowl. Prairie potholes, rivers, reservoirs, and inland lakes from Montana to south Texas form the Central flyway, while the Pacific flyway follows the west coast from Alaska to Mexico. Millions of birds rely upon the wetlands along these flyways to make foraging stops on their journeys to and from wintering areas. In addition, they provide nesting and foraging habitat for millions of breeding waterfowl and other birds. Yet the existence of much of this wetlands habitat is threatened.

In the United States, waterfowl population numbers have fluctuated with drought cycles since 1955, when the U.S. Fish and Wildlife Service published its first formal surveys. But the overall trend has been one of declining numbers, largely because of the loss of wetlands. Every two years, wet-

land areas the size of the state of Rhode Island disappear in the United States. Many wetlands are deliberately drained for cultivation, construction, or other types of development. Others are so disturbed by pollution that the plants and animals are unable to survive.

To combat the loss of vital wetlands, which are often of critical economic as well as wildlife conservation importance, the governments of the United States and Canada are cooperating to begin a long-range North American Waterfowl Management Plan. By the year 2000, planners hope to restore the continent's waterfowl populations to the level of a decade ago. Nature conservation organizations are trying to preserve wetlands through purchase of existing wetlands areas and restoring former ones; many are trying to rebuild the wetlands "stage."

In much the same way, a new wetlands habitat has been created at the National Zoo to show visitors how much splendid diversity is at stake if wetlands habitats cannot be saved. Moreover, the new exhibit is certain to be a good show, and you won't even need a ticket to see the play.

—Elizabeth Frank Stevens
NZP Curatorial Intern



many years, there has been a small nesting colony of tree-living black-crowned night herons near the bald eagle enclosure outside the Zoo's Bird House. As the name suggests, these birds are unusual among herons in that they tend to feed at night and rest during the day. Still, the birds do some feeding during the day and while they are incubating eggs, one can see a ceremonial "changing of the guard" at each nest as birds arrive and take over incubation duties from their mates. As the birds change places, they turn to face each other, elevate their long head plumes, rattle their bills, and make a soft "wok, wok" call.

Protective Measures

Around the turn of the century, demand for exotic plumes for ladies' hats threatened many species of herons and ibises and pushed the snowy egret and scarlet ibis close to extinction. A movement to protect wading birds—part of a growing sentiment to conserve vanishing American wildlife—arose in response, however, gaining momentum with the 1905 murder of an Audubon Society warden by plume hunters in the Florida Everglades.

Following the enactment of protective legislation, wading bird populations recovered steadily in the first half of this century, only to face a new threat after the 1950s. Then, newly developed insecticides, such as DDT, became concentrated in high levels in the bodies of wading birds (as well as other species). The cycle is now well known: Pesticides enter waterways through runoff from agricultural lands and progress through the food chain. At each level the concentration of such pesticides becomes higher. Birds such as herons, storks, and ibises are at the top of the food chain; they feed on fish, which feed on aquatic invertebrates, which in turn feed on single-celled algae. Thus these birds receive the highest levels of pesticide in a contaminated ecosystem. DDT causes herons and other birds to lay thin-shelled eggs and so they rarely produce viable young. Even the outlawing of DDT and related pesticides in the U.S. has not entirely solved this problem. Snowy egrets breeding in Idaho have recently been found to contain high levels of toxins, acquired during their winter stay in Mexico where such pesticides are still legally used.

In the Gulf Coast states in recent years, wading birds have faced trouble



from an unexpected source. Fishermen of Southeast Asian origin, unaware of American laws protecting birds, have collected eggs and chicks for food from nesting colonies of snowy egrets, great blue herons, roseate spoonbills, and other species. This local problem, however, is far easier to solve than that of pesticides. Increased surveillance, education of the immigrant fishermen about American law, and such simple practices as marking heronries and other bird breeding grounds on the Gulf Coast of Texas with warning signs in Vietnamese as well as English should alleviate this recent threat to wading birds.

In ancient Egypt, ibises were believed to be incarnations of the god Thoth, the god of wisdom credited with the invention of hieroglyphics; the long, curved bill of the ibis evidently reminded the Egyptians of a scribe's pen. In other parts of the world as well, religion and folk beliefs have provided protection for wading birds. In Japan, some heronries have been protected as sacred places for centuries. In Europe, the white stork was known as a bringer of good fortune, and its nests were allowed to remain on rooftops even in large cities.

Such beliefs may seem superstitious to us, but there is a certain wisdom to them. Wetlands and estuaries are extraordinarily productive ecosystems, producing fish and shellfish, which provide an important, protein-rich supplement to human diets. When these shallow-water ecosystems are healthy, wading birds flourish. It is common sense to protect wading birds, not only because of their beauty, but also because their survival is a sign that wetland resources continue to thrive. □

Dr. Hughes works at the Center for Demographics and Population Genetics at the University of Texas.

*Above left: One of the most magnificent waders, the great egret (*Casmerodius albus*) has recovered from near extinction due to plume hunting. (Photo by Jessie Cohen)*

*Below left: A unique method of filter-feeding sets flamingos (*Phoenicopterus ruber*) apart from other wading birds. (Photo by Jessie Cohen, NZP Graphics)*



Look-Alikes

What's green, lives in trees, and strikes with lightning speed?

If you guessed the emerald tree boa or the green tree python—or both—your answer would be correct. Although these two species, or kinds, of snakes come from opposite sides of the world, they look and act alike. Let's take a closer look at how this happened.

Parallel Paths

Some species look alike because they're closely related. Dogs and wolves are a good example. They look alike because they are close cousins.

But some species look alike because they live in the same kind of habitat. Dolphins and seals have a streamlined shape and other features designed to live in the water. Yet they are only distantly related. The two green snakes in the pictures above live nearly 12,000 miles from each other. They are not as closely related as dogs and wolves, but look alike because they both live in jungles.

Habitat and lifestyle help to shape the way animals look. Both the green tree python and the emerald tree boa live in the canopy, or upper levels, of tropical rain forests.

Here, their bright color blends into the leafy background. While at rest, both species hang coiled around a branch looking like a droopy leaf or even a bunch of green bananas.

As tree dwellers, they both have prehensile, or grasping, tails that hold



Green tree python (Chondropython viridis). (Photo by Jessie Cohen, NZP Graphics)



Emerald tree boa (Corallus caninus). (Photo by Jessie Cohen, NZP Graphics)

tightly to branches. This "anchor" keeps them from falling 50 feet or more to the forest floor. Using speed and very long front teeth, these expert hunters are even able to catch birds—a favorite

dinner. Their diets also include small mammals and tree lizards.

Even their babies are colored in much the same way. Young green tree pythons and emerald tree boas can be brilliant orange to brick red. These unusual colors may help them blend into a slightly different part of the canopy. Slowly, the green appears as they

grow older and move to new places in the trees.

What's The Difference?

These two species look very much alike, but they are different in two noticeable ways. The emerald tree boa gives birth to live babies, while the green tree python lays eggs. Both species have heat-sensing pits along their upper lips to help them locate prey. However, the green tree python has its pits *in* the scales while the emerald boa has these pits *between* the scales.

Be sure to visit the Zoo's Reptile House to see the emerald tree boa and green tree python on exhibit. And while there, look for the young emerald tree boa and green tree python in the demonstration window.



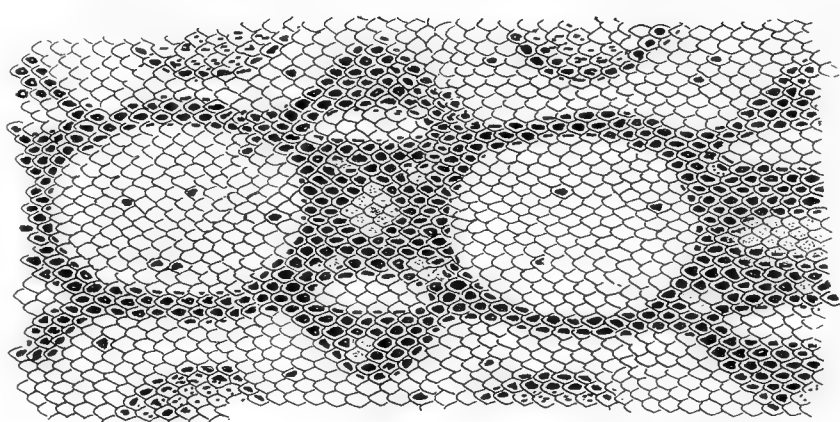
Emerald Tree Boa



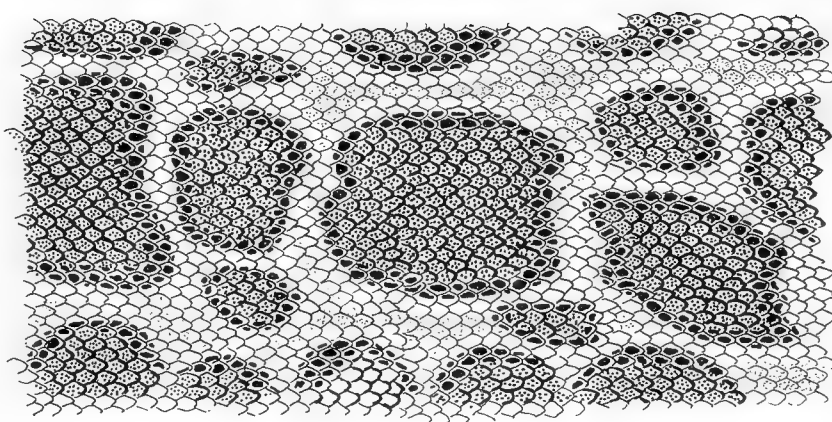
Green Tree Python

Hide-and-seek

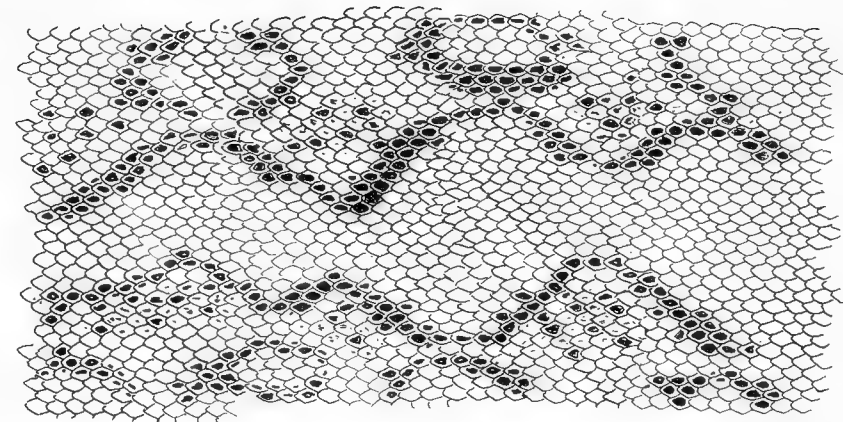
Playing hide-and-seek is fun for us, but for many snakes, hiding is a way of life. Being nearly invisible may make the difference between catching a hearty meal and being a meal for someone else. A big part of being camouflaged, or nearly invisible, is having colors and patterns that blend into the background.



Boa Constrictor



Burmese Python



Reticulated Python

Marked for Life

There are about 2700 species of snakes. And hardly any two have exactly the same design. Each species has colors and patterns that best fit its habitat. These colors and patterns are one example of how snakes have adapted, or changed to suit their environment.

The unusual patterns shown above belong to the boa constrictor, the Burmese python, and the reticulated python. These patterns are bold and easy to see on this page. But they are harder to see in the snakes' native habitat—the tropical forest. Why is this? The forest is a

place of light and shadows. As sunlight shines through the trees, it is broken up by the leaves and branches in its path. If a forest snake can copy this dappled look, it has a greater chance of surprising and catching its prey. Dark bands and lines break up the snake's outline while lighter shades of green and brown blend into tree bark and leaves. To our eyes, snake patterns are a lovely combination of lines, colors, and textures. For the snake, these patterns help camouflage it in the natural environment.

(Illustrations by Jeff Boyd)

Make A Snakeskin

You can create your own "snakeskin" by making a pattern rubbing.

Materials:

1. A long piece of paper.
2. Crayons or pastels
3. Items from around the house with lots of texture—almost anything with bumps or cracks will work.

Draw an outline of a snake on the paper. Place the paper over one of the items and rub the image with a crayon. Be creative with your choices of textures—combs, walnuts, rocks, cheese graters, the sidewalk, or tree bark will work. Then fill up the rest of your snake outline with other texture patterns.

Beauty Is More Than Skin Deep

Those beautiful patterns so important to the snake's survival are also very well liked by people. Tens of thousands of snakes are killed every year and their skins become shoes, purses, wallets, watchbands, and luggage. The heavy trade in snakeskins greatly lowers the numbers of snakes in the wild. The larger

species like boa constrictors and Burmese and reticulated pythons are some of the hardest hit.

To protect snakes and other animals, the United States and many other countries limit the number of reptile products that enter the country. This is done through CITES, the Convention on International Trade in Endangered Species. Customs officers at airports are always on the look out for illegal wildlife products. Travellers must have permits in order to bring them into the country. Since only certain snakes are protected, officers must identify the type of snake used in making the item. They will often look for special skin patterns and markings to help them recognize species.

Be a Customs Official

Can you identify the kinds of snakeskins used in making the items below? For clues, look at the patterns on the facing page. Write their names in the spaces below.



1. _____



2. _____



3. _____

Answers: 1. Reticulated Python. 2. Boa Constrictor. 3. Burmese Python.

For Reptile Enthusiasts:

If you find reptiles fascinating and like to color, you might enjoy the new *Reptalphabet Encyclopedia Coloring Book* by Keith A. McConnell. Realistic drawings of reptiles from A to Z accompany information on coloring, habitat, feeding habits, and folklore. The illustrations are detailed and present a challenge for the real coloring buff. (Stemmer House Publishers, \$5.95.)

Kids

F O R C O N S E R V A T I O N

Children in Brazil and Washington, D.C., practiced long hours learning to leap like tamarins, slither like snakes, and sniff like anteaters. Why? Because they were actors in a special play about wildlife and wild places—*The Tamarin Trickster*.

The play tells the story of animals in a Brazilian forest who band together to save their home. The production was an important part of the Golden Lion Tamarin Project—an effort to help this tiny, endangered monkey and its quickly disappearing habitat. The few hundred golden lion tamarins left in the wild live in and near the Poco das Antas Reserve in the Atlantic coastal forest of Brazil. This reserve is just 40 miles outside Rio de Janeiro—one of the largest cities in the world.

The play began in Brazil as a way for children to teach other children and their parents about the problems facing the tamarins and their wildlife neighbors. Lou Ann Dietz, a National Zoo educator, worked with the play's author and a local teacher to cast the children. The list of characters included an anteater, a sloth, a boa, tamarins, the brook, the breeze, woodcutters, and an ancient tree—

all parts of the real Brazilian forest. None of the children, ages 11-16, had ever appeared in a

full-length play before so a lot of time and energy went into each rehearsal. Even the set was painted by high school members of a conservation club.

Lights—action! The first performance in the town square of Silva Jardim, a small town near the tamarin reserve, was a resounding success. As they crawled, climbed, and jumped across the forest stage, the actors captured the imaginations of their classmates and families. The play even went on the road and was performed five more times in nearby towns. It was such a hit that the people of Silva Jardim chose conservation as the theme of their largest festival, the annual *Carnaval*.

This spring, here at the National Zoo, a similar event took place. *The Tamarin Trickster* was translated from Portuguese into English. Then the Children's Theatre of Arlington chose young actors and designed whimsical costumes and a lush tropical set. The production was new, but the message was the same: Help save the forests of the world. This time the children and families sat in an auditorium 5000 miles from the Brazilian forest. But the beauty and concern for life retold in Washington, D.C., took the audience for a brief moment to the Poco das Antas Reserve and to the trees and animals that call it home.



The National Zoo cast with lavish tropical set. (Photo by Angela D. Wessel)



Original production of The Tamarin Trickster in Silva Jardim's town square. (Photo by Lou Ann Dietz)

NEW ZOO FACES

A pair of maras have taken up residence in the hoofed stock area. If these large South American rodents, also known as Patagonian cavies, look familiar, it's probably because they are related to the guinea pig. The mara's extra long legs are used for quick escapes and excavating burrows.

Looking a bit like a Steven Spielberg character, the Zoo's new Vietnamese pot-bellied pig will be on display in the Elephant House. This 39-pound porker is a domestic variety named for its obviously well-endowed middle.

Just over nine ounces at birth, a newborn larger Malayan chevrotain, also called a mouse deer, can be seen on display with his parents in the Small Mammal House. Eating well and gaining weight, he is the first of this species born at the National Zoo.

Finally, look out for spectacled bear cubs emerging from the den and an enclosure of last summer's open-air, free-ranging tamarin exhibit in Beaver Valley.

A VIEW FROM GIBBON RIDGE

The male siamang walked boldly into the new exhibit. He moved quickly through the upper and lower levels, exploring every nook and cranny. The female was much more tentative in her approach. She allowed the male to reconnoiter the unfamiliar terrain, remaining behind with her youngster until the "all's well" signal was sounded. Since these first moments in their newly completed outdoor habitat, the siamangs have adjusted well to the "forest" environment. They seem to enjoy the expansive view of Beaver Valley where the activity of seals and sea lions is something new to watch. On his first encounter with real ground, the male grabbed a handful of dirt and promptly began to eat it—a behavior he did not repeat after realizing that dirt was not a delicacy. The new exhibit allows brachiation at its best. These amazing apes "fly" through the trees, putting even the best Ringling Brothers trapeze artists to

shame. For the Zoo visitor, the new exhibit provides an exciting glimpse into the natural world of siamangs and gibbons.

FOCUS ON PHOTOGRAPHY

'Tis the season for births at the Zoo, and with sharp eyes, patience, and the right camera technique, you can capture animal babies on film. This spring, keep an eye out for young dorcas and dama gazelles, two baby orangutans, twin spectacled bears, prairie dogs, clinging infant gibbons, swans riding on their parents' backs, and voracious crane chicks.

To the delight of those Zoo visitors who happen to be in the right place at the right time, some animals—usually only the diurnal, open habitat ungulates—give birth in the open, during the day. For instance, I have recorded the entire process of giraffes, dama gazelles, and white-bearded wildebeest giving birth.

Spring is the best time to photograph ungulate calves. Some very young ungulates hide from predators by lying in grass, bushes, or depressions and only come out to nurse. However, a calf will sometimes hide in the

perfect spot for a photographer. One spring the baby dama gazelles chose open depressions right at the front of their enclosure; perhaps they "thought" they were hiding but actually gave Zoo visitors a made-to-order photo opportunity.

As you wander through the Zoo, look carefully for hidden or camouflaged gazelles or a kangaroo joey poking his head out of the pouch. When shooting, consider how you would like the animal to appear in the photograph and choose the corresponding camera angle. If you want the animal to appear small you can shoot it from above or at a high angle. If you photograph a gazelle baby with the camera at or slightly below its eye level, the baby will appear larger and more prominent in the photo.

As dorcas and dama gazelle babies grow older they frolic and play, offering an opportunity to practice your technique for capturing action. A shutter speed of about 1/500 of a second should be fast enough to "freeze" the action. Patience is an equally important ingredient—watch an active animal and anticipate what it will do next so that you are ready at the decisive moment.



Mother dama gazelle with young. (Photo by Jessie Cohen)

The equipment most useful for photographing babies varies with the exhibit, but generally you will need longer lenses, with a tripod or guard rail for camera support. Often you can get close to the prairie dogs, which have many babies on view each spring. Use a short telephoto lens (100mm) or your 70mm to 200mm zoom to capture their antics—playing, wrestling, and eating.

Don't forget the birds either! The cranes in back of the Bird House are busy sitting on their eggs or feeding hungry chicks. Lenses ranging from about 100mm to 300mm and teleextenders are useful depending on whether the animal is in the front or in the back of the exhibit.

When using color film, experiment with interesting possibilities. Try making a monochromatic picture of the tan prairie dogs against a background of beige earth. Or, for a striking photo, try snapping a rusty-orange orangutan mother, carrying the baby on her head, against the brilliant green grass.

As you prepare to shoot, try to visualize the finished photograph. Which is the best lens and angle to shoot from? Which subject will achieve the desired effect—diminutive or large, active or resting, subtle or dazzling? But whatever and however you choose to photograph at the Zoo, remember to enjoy your discoveries!

—*Jessie Cohen*

KEEPER'S CORNER

Two boys were looking at the turtle pond in front of the Reptile House which is labeled "Turtles Basking in the Sun," followed by a brief explanatory paragraph. One boy leaned over the railing, read the sign, and said, "Hey, look, Chuck—'Turtles Baking in the Sun.'"

—*Bela Demeter*
Reptile Keeper-Leader

THINK GLOBALLY, ACT LOCALLY

On June 5, 1988 Americans across the country and concerned citizens around the world will celebrate World Environment Day. This year's theme forges "New Partnerships for the Planet" for a better environment tomorrow. The Global Tomorrow Coalition encourages citizens to join together with friends in a project that will have impact—planting a tree, writing an environmental article, organizing a field trip to a local nature

site, or holding a World Environment Day celebration at school. For further information on effective participation in World Environment Day, contact the Global Tomorrow Coalition at (202) 628-4016.

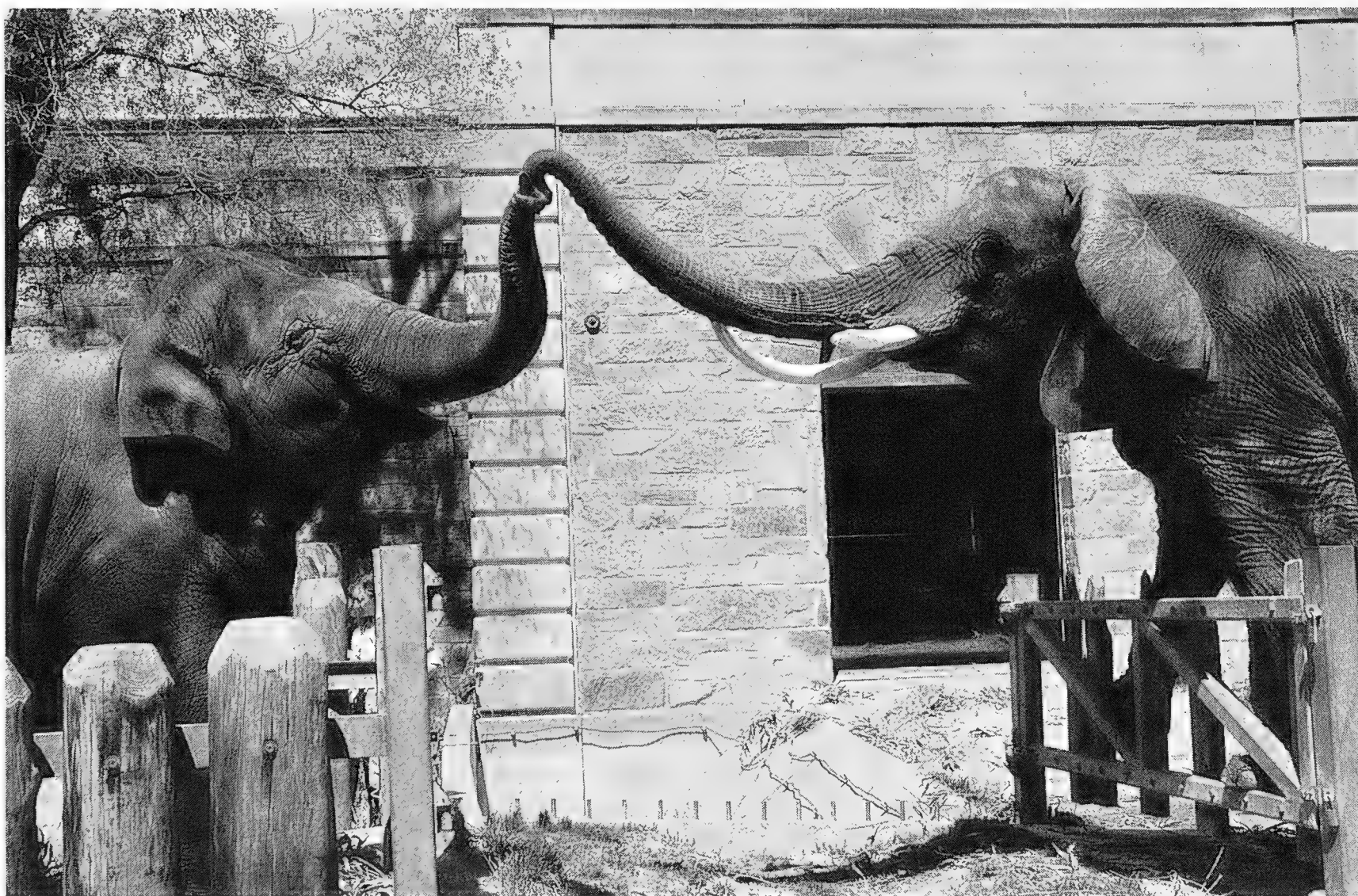
XYZ X-PLOERS

FONZ's XYZ (X-plore Your Zoo) Club is an exciting program for 12-16 year-olds interested in wildlife. The Club meets every other month, examining topics such as zoo keeping, zoo medicine, and animal nutrition. Members also receive *ZooGoer* magazine, an XYZ Club t-shirt, and an invitation to the annual Club picnic. Special summer activities include performing a conservation pup-

group of dedicated college students—some of the brightest and best of future zoo professionals. To help them, please call Mary Sawyer Hollander at 673-4955.

HAVE YOU HERD?

The ground has been shaking recently with the deep rumbles of elephant infrasounds. The Zoo's 34-year-old African elephant, Nancy, is slowly being introduced to her two Asian counterparts in an attempt to form a social group of female elephants. (Studies in the wild have shown that elephants belong to matriarchal herds, usually composed of related females and their offspring; female elephants are not found alone.)



Initial elephant introductions. (Photo by Jessie Cohen, NZP Graphics)

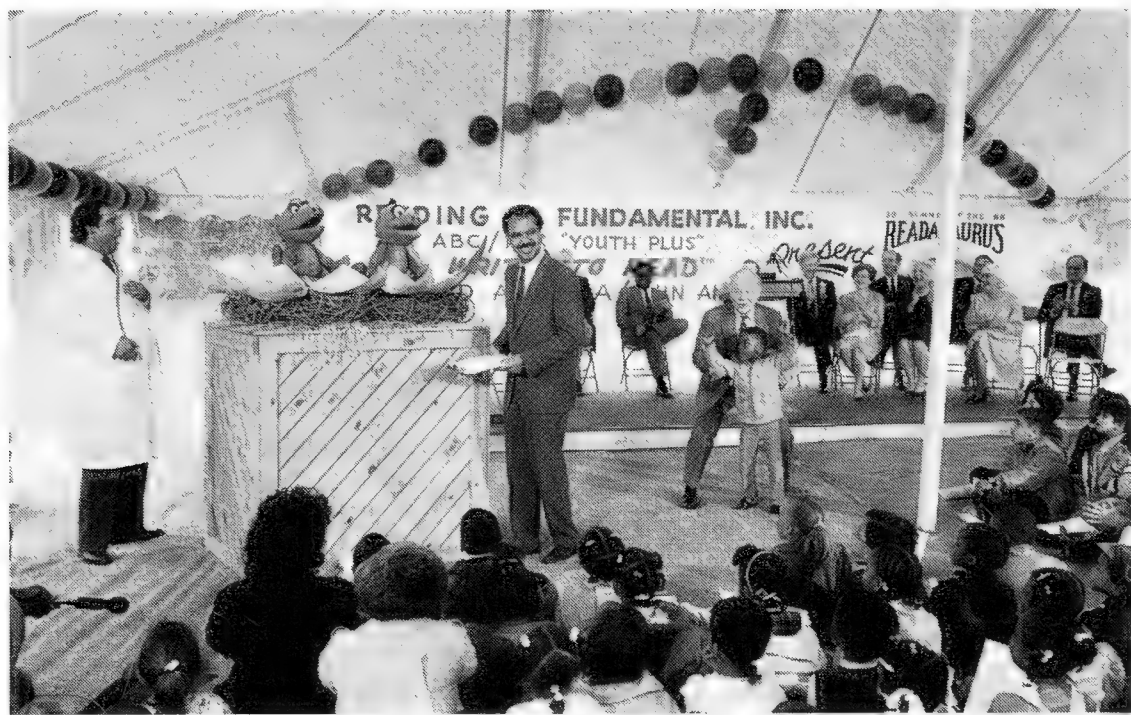
pet show and serving as class aides in our children's Summer Safari Program. To be eligible for these summer programs, new memberships must be received by June 5th. For information and an application form, please call 673-4955.

HELP A FONZ INTERN

FONZ summer interns will need housing near the Zoo or near public transportation from late May to early September. If you have a room in your house that will be empty this summer or if you need a housesitter, why not help a budding biologist?

These interns are a very select

To date, the introductions have been restricted to meetings over the fence, using the rhino yards as neutral territory. Trumpeting, dust-kicking, ear-flapping, and trunk-slapping were among Nancy's initial reactions. Just three days later many of these aggressive behaviors had diminished, to be replaced by exploratory touching and smelling—an elephant's natural way of communicating. Nancy, always the initiator, has been observed gently touching the younger of the two Asian elephants with her trunk. Many obstacles still remain, but with consistent efforts, Nancy may soon be a vital member of an interactive and social elephant group.



Readasaurus hatching. (Photo by Rick Reinhard, courtesy of Reading is Fundamental)

READING IS FUN

The recent discovery of a dinosaur "egg" in Alaska had the scientific world in an uproar. On May 3rd the egg hatched at the National Zoo revealing a completely new species—Readasaurus. Readasaurus and the Reading Is Fundamental (RIF) group are launching a program for children to promote the importance of reading during the summer months. During June, July, and August a drop-box located in the Education Building lobby will receive entries of books read by young contestants. Drawing of winners will take place in September. For more information on RIF, please contact Nancy Sullivan at RIF, 287-3450.

ZOONIGHT

Come to ZooNight June 3 (FONZ members A-M) and 17 (members N-Z). Look for your invitation in the June-July issue of *Wildlife Adventures*.

NZP HISTORY

For more than half a century, scores of animals at the National Zoo freely wandered throughout the Park, mingling with visitors, tagging behind strollers, and patrolling the outdoor exhibits. These free-ranging beasts were not lions or tigers or bears, of course. They were *Pavo cristatus*—better known as peacocks and peahens.

Until 1975, a peacock's courting display was one of the most delightful spectacles at the Zoo. The male would shake his rattling quills, then quickly move ahead of his intended mate and spread his magnificent fan of feathers—eight feet wide with as many as 150

"eyes"—in a striking display of iridescent blues, greens, and golds.

Alas, the final curtain had to be brought down on this crowdpleasing performance, as the star attractions were determined to take their show on the road. Despite the dozens of open acres at their disposal, the peacocks seemed to be afflicted with an insatiable wanderlust. This problem came to a head in the mid-1970s when, as more than a few exasperated motorists probably

remember, it was not uncommon to see Curator of Birds Guy Greenwell, his staff, and even Zoo Director Theodore Reed dodging rush hour traffic on Connecticut Avenue as they tried to persuade their avian charges to make an about face and return to the Park.

Such escapes were most frequent in the spring, Reed recalled, as the females became restless and the males followed their lead. Penning up the females did keep the males at home, but the Zoo's pressing need for space finally led to the birds' banishment.

Exiled to the wide-open spaces of the Zoo's Conservation and Research Center (CRC) in Front Royal, Virginia, the peacocks had to adopt a new country lifestyle—in other words, learn to elude

"fowl" play at the paws of a hungry fox. With this threat in mind, keepers diligently collected and penned the roving birds at night until a new generation of farm-bred fowl had learned to roost at a safe height from the ground.

Treasured in the kingdoms of its native Southeast Asia, the peacock was first introduced into Europe as a result of the conquests of Alexander the Great. As its numbers slowly spread across the continent, the peacock's snob appeal ballooned. In the 19th century, owners of great estates the world over kept fashionable flocks to roam (and call attention to) their vast green lawns. The decorative value of these animated ornaments was decidedly enhanced by a most practical one—the birds' raucous, cat-like cry served as a natural burglar alarm. (Long before peacocks graced the grounds of the National Zoo, President James Monroe kept a flock at his estate near Monticello; a few years ago the Conservation Center donated some of the Zoo's birds to create a new flock at that historic site.)

According to National Zoo Historian Billie Hamlet, NZP's first peacock arrived in 1891, followed by a second, the gift of President Benjamin Harrison, two years later. Thriving under human care, the peacocks multiplied—well, like rabbits, and by 1914, 80 birds were listed as residents of the Zoo. Thereafter, peacocks did not even warrant a mention in the Zoo's annual reports, so stable and apparently unremarkable



Face painting at ZooNight. (Jessie Cohen, NZP Graphics)

was their near-capacity population.

Postscript: In the early 1980s, the Zoo staff, missing the colorful peacocks, relented and recalled just one—Joe Junior, a male that had been hatched at Front Royal. But, alas, Joe Junior had the old peacock wanderlust in his blood, and without so much as a single female to lead him astray, he marched himself out of the Park in August 1982 and was shortly recaptured on the roof of a Quebec Street apartment house. AWOL again just one month later, Joe was tracked down and packed off with thanks to the Conservation Center, so he might live out his days on the land, far from the hazards of the big city streets.

So if the rush hour traffic should sometimes snarl to a halt outside the Zoo's Connecticut Avenue gates, no one can blame it on wandering Joe anymore—drivers will simply have to grin and bear it, and chalk up the gridlock to the glittering ghosts of NZP peacocks past.

TROPICAL TREASURES

May 21 marks the opening of "Tropical Rainforests: A Disappearing Treasure" in the International Gallery of the Smithsonian's new S. Dillon Ripley Center. Visitors will be introduced to the world of the rainforest through a variety of innovative displays, including videos, murals, computer games, a life-sized model of a section of a buttressed fig tree—an important link in the tropical forest ecosystem, and a five-screen, 180-degree slide and sound presentation shot in Borneo. Emphasizing the diversity of this fragile ecosystem, the exhibit will highlight the ecology and people of the tropical forests, as well as rainforest destruction, with its causes, consequences, and possible solutions.

The exhibition will continue through January 2, 1989, and then travel to 12 U.S. cities over the next four years. For further information, please call 357-2700.

RESEARCH UPDATE

Incessant Singing

You can admit it. We all have the same thought at this time of year: When will that bird shut up? Entering our consciousness as we sleep, mockingbirds seem to sing morning, noon, and night. For the last several years, I have been trying to describe this cacophony and understand the role of singing in the

lives of mockingbirds.

In addition to its unusual nocturnal singing, the Northern Mockingbird (*Mimus polyglottus*) is renowned for its extraordinarily large vocal repertoire. One male virtuoso I recorded sang at least 412 acoustically distinct songs during a single breeding season. More typically, male mockingbirds sing as many as 250 different song types each day, a phenomenal number compared to most bird species in which males sing only from one to 20 different songs. However, the size of a male mockingbird's repertoire is not fixed. Early in the breeding season, before a male ac-



Tropical forest tree buttress. (Photo by Steve Brosnahan)

quires a mate, he sings a fairly large repertoire of about 170 different songs. But when a female arrives on his territory, his already extensive repertoire grows by approximately 25 percent as he sings many rarely heard and possibly even innovative songs. Then, once the female begins lining the nest with small roots and grass, a signal that she is committed to the male, a male's repertoire decreases in size until it reaches a low of only about 90 songs when nestlings or fledglings are present. This cycle may be repeated several times because mockingbirds nest over and over again during the breeding season. How a male presents his extensive repertoire also changes through a breeding cycle. Males usually repeat a song several times before switching to another type. Thus, males can vary the presentation, or versatility, of their repertoire by changing the number of times a song is repeated before switching, and by altering the frequency of returning to sing a particular song.

Before a female arrives, male mockingbird song is versatile—males change song types frequently and return infrequently to a song type already sung—and even more so after a female arrives and courtship begins. Then, like repertoire size, versatility declines when the female begins to line the nest. However, unlike repertoire size, the least versatile singing is heard not during incubation but when males interact with neighboring males. Thus, males sing the greatest number of different song per minute during courtship and the least during interactions with other males, suggesting that male mockingbirds may use versatile song to attract and stimulate females.

During the past two years, most recently with FONZ support, I have been conducting experiments to test this hypothesis experimentally. For instance, I exposed females to pairs of taped songs differing only in their versatility, and found that females do indeed prefer more versatile singing. Females approached and spent more time near the source of the more versatile singing than the less versatile singing. Further, females distinguish between the singing of male mockingbirds and that of other species, even if the other species' singing is versatile.

This spring I am conducting further experiments in the Zoo's Great Flight Cage near the Bird House. Male and female mockingbirds are being released one at a time into the cage, where they are expected to set up a territory. Then, I will "challenge" them with the recorded songs used above to see how they respond to the various tapes and whether the sexes respond differently.

Oh yes, what about the male that keeps us awake with his all-night singing? Is there anything we can do to get some peace and quiet? Probably not. Away from human settlements, only unmated males sing at night, and the incessant nocturnal singing ceases once a male is mated. But because of the human propensity to artificially light the world, we have turned the city night into an extended dawn. As a result even mated males sing during the night throughout the summer. Your best bet is to relax and enjoy the mockingbirds' musical song—and be grateful that you are not counting their songs as I find myself doing while I struggle to return to sleep.

—Kim C. Derrickson
Department of Zoological Research

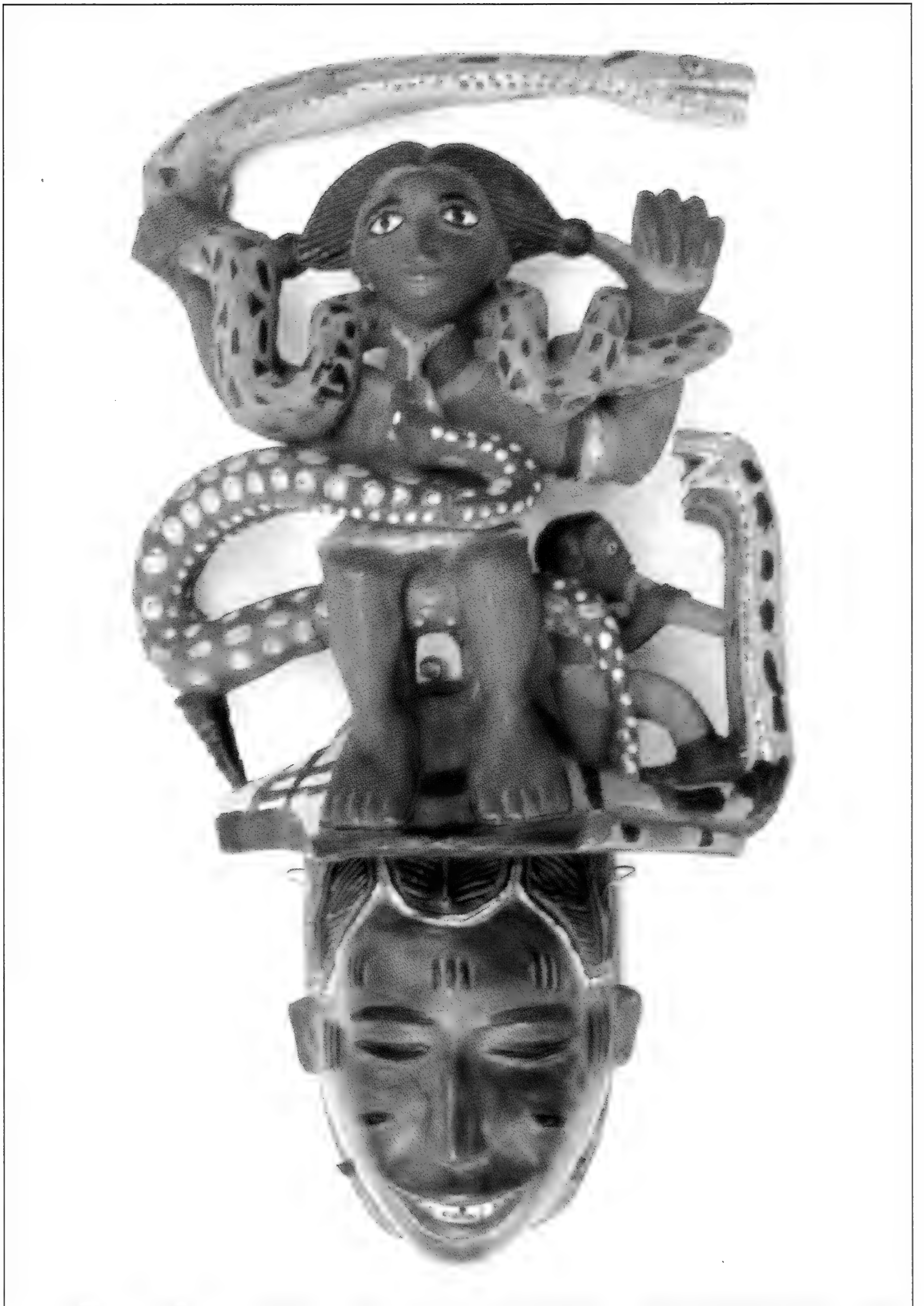
Boas and Pythons: the Giant Constrictors

Marianne Hughes

Gaea, the preclassical Greek goddess of the earth, had a shrine on Mount Parnassus from which her priestesses foretold the future. Gaea was able to assume the form of a snake; in her serpent form she was called Python. The sun god Apollo eventually took over the shrine, but only after a ferocious battle in which he killed Python. To placate her ghost, Apollo ordered that all priestesses who prophesied there should be called Pythia (pythoness), a term which became synonymous with soothsayer.

Most people would have no trouble imagining what Python might have looked like as she fought Apollo. Members of the family Boidae—the pythons and their relatives the boas—are nearly as familiar to us as the “common snakes” (family Colubridae, the garter snakes, racers, milk snakes, etcetera). Compared to the common snakes, however, the boids are a surprisingly small family, with fewer than 100 member species; some authorities credit Colubridae with over 2,000 species. Also, unlike the common snakes, the boids are not often seen in nature. Their preferred habitat is tropical forests, but at least a few species are found on every continent except Antarctica. Two boas make their homes in North America: The rosy boa occurs throughout California and the rubber boa inhabits the entire West Coast as far north as Puget Sound and British Columbia.

For our family, a trip to the Zoo frequently begins in the Reptile House with the “giant snakes.” Within the Boidae are all the world’s largest snakes—species that reach a length of 20 feet or more (In more than 99 percent of all species, the snakes are less than 10 feet in length). The biggest is the South American anaconda, called *sucuri* by Brazilian Indians. Herpetologists have occasionally measured anacondas that exceeded 37 feet. Unverified estimates go much higher, up to 156 feet for an individual that was reported in a Brazil-



“Mammy Wata” mask from the Ivory Coast. (Photo by Bruce Haight. Donor to Museum of African Art—Eliot Elisofon. National Museum of African Art, Eliot Elisofon Archives, Smithsonian Institution.)

ian newspaper in 1948 to have terrorized a town by knocking over buildings and cars. Actually, anacondas seem to prefer to stay concealed in streams and swamps of the Amazon basin, well away from human habitation. Much more sociable are two other giants, the reticulated python of Burma (25-30 feet) and the Indian python (over 20 feet). These snakes are frequently seen in cities, where they help themselves to domestic chickens and ducks.

The fossil record for snakes is relatively incomplete, but it is generally accepted that snakes evolved from lizards. The best evidence for a close relationship between these two groups comes from comparing reptile skulls. Snakes and lizards are more similar to each other in the structures of their skulls than either is to any other reptile group. In particular, both snakes and lizards have similar modifications in the attachment of the lower jaw which increase the degree to which the mouth can be opened. Detailed examination of fossil skulls convinces many herpetologists that snakes evolved from ancestors of the monitor lizards as early as 130 million years ago. Certainly modern monitors (such as the water monitor) look nothing like modern snakes, but some of their ancestors had very long bodies and short legs and must have looked remarkably snakelike. The earliest complete fossil snake is *Dinilysia patagonica*, a five-foot specimen from Argentina that lived over 65 million years ago. The first true boas appeared in the fossil record less than 10 million years later. Much scientific interest in boids living today comes from the fact that they represent a very ancient group of snakes.

The combination of primitive and advanced features in the Boidae offers insight into the course of their evolution. Of course, in a discussion of evolution, the terms "primitive" and "advanced" do not imply a judgment about the quality or worth of a particular characteristic. Primitive features are those which evolved relatively early; advanced features evolved later. The most striking example of a primitive feature in the Boidae is probably the pelvic girdle, that part of the skeleton which in other vertebrates serves to attach the hind legs to the backbone. Even though they no longer have functional legs, boids retain a pelvic girdle. Tiny remnants of hind legs, the claws or "spurs," are visible at the level of the pelvic girdle on either side of the cloa-

ca. The pelvic girdle and spurs, which also occur in members of three other ancient snake families, are strong evidence for the evolution of snakes from lizards. Another primitive feature, which is essentially unique to the boids, is a left lung that is more than half as large as the right. In most snakes, the left lung is vestigial or completely absent, permitting a more streamlined body shape. Streamlining the body could have been advantageous for burrowing snakes or those that lived in dense ground vegetation, two lifestyles which only a few of the boids have adopted.

The jaws of boids are advanced features. The lower jaw is attached to the skull, not by a joint, but by two small bones on either side. These small bones are attached to the skull, to the lower jaw, and to each other by means of flexible joints. When the mouth is opened, the bones swing not only down but sideways, bulging out and enormously increasing the size of the mouth opening. Consequently, boids are able to swallow prey items of considerably larger diameter than the boids themselves. This ability is undoubtedly the basis of stories that credit boas and pythons with some very unlikely meals. For example, pieces of scholarly Medieval literature from both Europe and China contain accounts of Indian pythons routinely including elephants in their diets. In fact, a 130-pound impala taken from the stomach of a 16-foot African python is the largest boid meal that has been reliably documented.

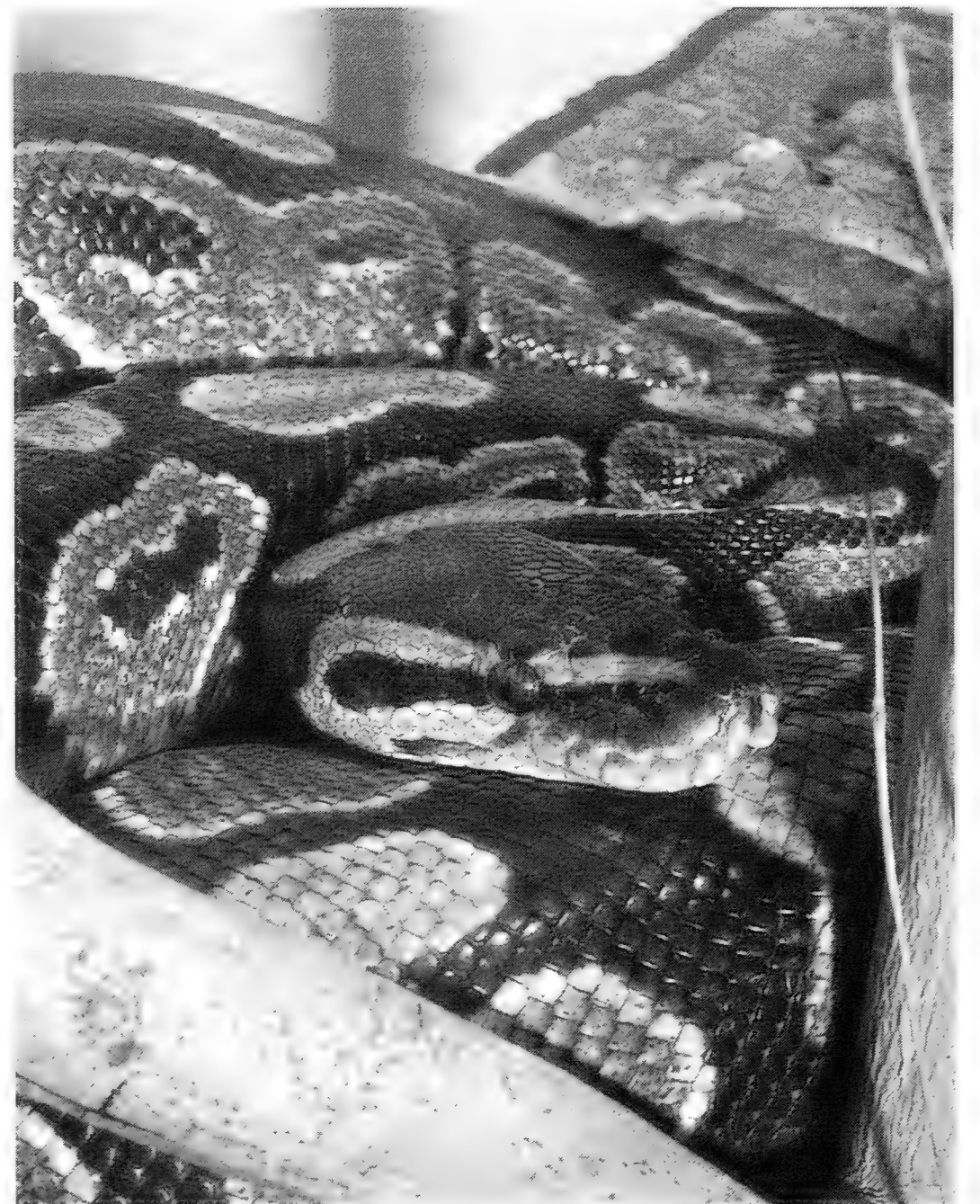
A python with an impala in its stomach makes an interesting story, but the everyday diets of boids are not so exotic. Small mammals (especially rodents), lizards, birds, and sometimes fish are much more likely items. Boids are not highly specialized in their food preferences; they eat what is most plentiful.

In nature, boids tend to feed at night, waiting in ambush for unsuspecting prey. Although boas and pythons

are not poisonous, they seize prey with a strike that is at least as fast as a rattlesnake's—about 20 feet per second. The strike serves to secure the prey while the snake coils around it and applies constriction, or tightening, of the loops of the coil. Death is by suffocation; boids do not crush their prey to death. However, a frightened snake will sometimes regurgitate a recent meal. Erroneous folklore about victims "mangled to a pulp" may stem from observations of regurgitated prey.

Constriction killing almost certainly appeared very early in the evolution of snakes. Evidence for this comes from comparisons of the way in which different snakes make a constriction kill. In four primitive families, including the Boidae, the movements involved in seizing and coiling about the prey are identical. This pattern of prey handling occurs even in newborn snakes making their first kill. On the other hand, 19 different patterns have been observed in advanced snakes that use constriction, with different patterns appearing from time to time in the same individual. The persistence of a single prey-handling pattern in four primitive families means that this pattern must have been used by a common ancestor—making constriction killing well over 100 million years old. For boids, constriction killing plus flexible jaws made it possible to bring down and consume a wide variety of prey items. Conse-

A ball python (Python regius) forms a circular coil with head in the middle—a typical protective posture. (Photo by Jessie Cohen, NZP Graphics)



quently, over evolutionary time, boids were able to move into many new habitats.

Today, the Boidae consist of two major groups: boas, found mainly in the New World, and pythons, confined to the Old World. Besides geographical distribution, the two groups differ in another respect. Boas give birth to live young; pythons lay eggs.

Pythons are among the very few reptiles in which maternal care has evolved. Female Indian, reticulated, and green tree pythons incubate their eggs. After laying 30 to 50 leathery, oval, white eggs, the female gathers her coils about the clutch so that it is completely surrounded and covered by her body. When the environmental temperature drops, she begins making spasmodic muscular contractions which produce enough heat to raise the temperature of her eggs nearly 10 degrees. Herpetologists call these contractions "shivering" because they look exactly like the shivering of cold mammals. Shivering at 30 contractions per minute uses a lot of energy, but incubating python mothers often will not leave their eggs to search for food. They remain with a clutch for the entire 8-13 week incubation period, going away only briefly to drink.

A recent investigation by physiologists showed that female ball pythons do not shiver and are unable to raise the temperature of their eggs more than a fraction of a degree by coiling around them. In tropical Africa, their native habitat, incubation is not even necessary—environmental temperatures are uniformly high even at night during April through June, when females have eggs. Nonetheless, ball python mothers coil around their eggs and stay with them exactly like incubating species. Why should they do this? One hypothesis is that by staying with the eggs, the mother may be able to protect them from predators. It is not certain whether there are any egg predators within the ball python's geographic range. But if there are, guarding the clutch is as important to young pythons' survival as keeping them warm.

Pythons give maternal care only to their eggs. Once a clutch has hatched, the young are on their own and get no further attention from their mother. In fact, she may not even recognize them as her offspring.

Boas also are independent as soon as they are born. The developing young are carried in the mother's body



A man-made tree trunk provides a perfect setting in which to view one of the Zoo's tree boas (Corallus enydris). (Photo by Jessie Cohen, NZP Graphics)

as membrane-covered eggs, which will hatch shortly before or during birth. They receive oxygen and water through the membrane, but, unlike mammals, no food. The large yolk of each egg is the sole nutrient source for the entire gestational period. However, embryo boas are protected from egg predators and from mold—a serious problem for a poorly placed clutch of eggs. Inside their mother's body, developing boas also benefit from a temperature-controlled environment: The female can move them to a warm location simply by moving herself. Boas are found in cooler parts of the world than are pythons, and their live-bearing habit is the most likely reason for their colonizing success.

Though small in numbers of species, the family Boidae has representatives adapted to living in every sort of habitat from Arabian desert to tropical forest canopy. Ironically, it is only in this century that the future of some of these species has become uncertain. The U.S. Department of the Interior currently lists six boids as endangered or threatened; another 14 are considered in need of conservation and management—more than one-fifth of the entire family. The market for exotic pets and increasingly popular snakeskin products claims many thousands of boas and pythons each year. Between 1977 and 1982, for example, nearly 600,000

skins representing five boid species were imported into the U.S. Steps are being taken to reduce these numbers. Brazil, Papua New Guinea, and several other countries have recently banned exportation of all wild animals; and successful "sting" operations by the U.S. Fish and Wildlife Service have curtailed illegal trading in this country. A much more serious problem, however, is the destruction of the snakes' habitats by humans, which is the major threat cited for three-quarters of the boids currently at risk. An extreme example of habitat destruction comes from Round Island in the Indian Ocean, which is home for two species of boas found nowhere else in the world. The entire fauna of Round Island is likely to become extinct because of soil erosion from agriculture. The only hope for the Round Island boas may be in captivity, in breeding programs exemplified by NZP's successful efforts with the emerald tree boa and green python.

Snakes of all kinds have played a powerful role in human imagination through the ages. Belief in the snake's immortality was once widespread; it seems ironic, then, that the snake's age-old nemesis—man—now holds the key to this creature's continued survival. □

Ms. Hughes is completing her doctorate in animal behavior.

Ghost Tigers and Giant Sea Turtles

The struggle to save a Javan "island" paradise reflects global and local efforts to preserve intact the last of the world's wild places.

Susan Lumpkin and John Seidensticker

Sitting in the dark on the deserted shore, it is easy to believe in ghosts. The tigers that made their last stand here just a few years ago are extinct—I know that—but a faint rustling in the bushes, just audible over the crashing surf, brings them back to life. And me to my feet. The tigers may only be ghosts, but the leopard tracks along the beach are real, fresh. And who knows what other animal awaits the egg-laying of the nesting sea turtle as eagerly as we do, but with more predatory interest? Suddenly I am no longer just an alien visitor but a part of this wild place, perhaps little different from the other primates whose shrieks suggest that they too have heard a threatening rustle in the forest.

Indonesia's Meru-Betiri National Park lies in a remote corner of Java, an island that the renowned naturalist Alfred Russel Wallace in 1869 called "the finest tropical island in the world" and that many, prompted by the discovery

of the fossil "Java Man" in 1891, believed was the Garden of Eden. Java is still beautiful but little remains of the wild forests that evoked such high praise for the island; all but a small percentage of the island's area is under cultivation.

The 500 square kilometers that make up Meru-Betiri are part of this remnant wilderness, stretching from sea to mountain tops in a disjunct region of the Southern Mountains on the south coast of East Java. Isolation protects Meru-Betiri: Although not as inaccessible as in Wallace's day, it still takes four hard hours to drive from the small coastal city of Banyuwangi to Sukamade Beach at the core of the park, a distance of only 100 kilometers. One full hour is spent traversing the precipitous terrain of the last 20 kilometers where four unbridged rivers, passably shallow at the end of the dry season, must be crossed. But between jolts and bounces there is plenty of time to take

in the incredible vistas along the way.

The road from Banyuwangi winds for much of the way along canals that irrigate emerald green rice paddies and through small, busy villages of bamboo and thatch homes. People appear at every turn, bathing in canals, weeding rice paddies, resting under palm trees, and selling soft drinks and cigarettes from roadside stands. Children, neatly dressed in school uniforms—or nearly naked—are ubiquitous. In fact, Java is one of the most densely populated places on earth, with about 1500 people per square kilometer trying to make a living. And the population continues to grow. Virtually all of Java's land, even marginally productive land, must be claimed to produce food, fuel, and fiber for people.

This becomes evident as the road rises out of the flat land toward the forested peaks of the park's volcanic mountains. In the lower elevations, fields are fewer, but there is also little forest left; thick stands of bamboo mark areas cultivated in the recent past. This part of Java was virtually uninhabited at the beginning of the century. It was insulated from human influence by the rugged topography and even today the drive is a frightening roller-coaster ride. However, after about 1900, and more rapidly after World War II, the river valleys of the region were cleared as the native forests were converted to plantations of rubber, coffee, and teak. Meru-Betiri National Park, its primeval forests safeguarded by sheer, barren slopes and deep canyons, lies in the core of this region.

*Four species of sea turtles, including the green sea turtle (*Chelonia mydas*) lay their eggs on Meru-Betiri's protected Sukamade Beach. (Photo by John Seidensticker)*





Long isolated by mountainous terrain and a rugged coast, this “island” within an island is now almost surrounded by human-dominated landscapes. (Photo by John Seidensticker)

Thus, Meru-Betiri is an “island” on an island. Like most modern national parks, Meru-Betiri is nearly surrounded by human-dominated landscapes. Paddies, plantations, and plots of shifting cultivation rim the park and, in places, even penetrate its interior. These agricultural “barriers” contain the park’s terrestrial wildlife as effectively as the coast of its southern border, where the continental shelf drops abruptly into the Indian Ocean and

huge waves break on the steep, treacherous beaches.

But Meru-Betiri is an island in yet another sense as well. In the predominantly deciduous monsoon vegetation of East Java, much of Meru-Betiri is an enclave of lush evergreen tropical rainforest. High peaks in the northeast part of the park trap and cool the winds of the dry southeastern monsoon, and then through condensation give off rain against the south-facing slopes. Only

the far western part of the park is typical East Javan dry monsoon forest.

Meru-Betiri, however, contains more than just wet and dry forest. In fact, its floral diversity is unmatched in modern Java. The area boasts swamp forest, mangroves, a specialized riverine vegetation, and two distinct types of beach plant communities, one where the waves deposit sand and other where they do not. It is also the only known home of one species of *Rafflesia*,

a rare parasitic plant which, lacking leaves or stems, blooms only on the stems of a single genus of liana.

The scenery of Sukamade Beach is perhaps without parallel in the world. Great, glorious, magnificent waves crash against the beach and the sheer coastal cliffs to the east and west. Luxuriant forests cover the jagged mountains and ridges and spill over the seaward precipices. Here nature dominates. No other people or their artifacts are in sight or earshot, just some sea birds trying to make a living on the sandy beach and the long-tailed macaques chattering to one another in the forest. Later, just before sunset, pairs of wreathed hornbills soar over the Sukamade Valley as they leave off foraging to return to their nighttime roosts; just after sunset, flying foxes flap overhead (and occasionally closer!) as they leave their daytime roosts to forage for fruits in the high, dark forest. Other smaller bats fly from the rocky offshore islets to replace the sea birds on the beach.

Later yet, when the moon provides the only light and leopards begin to prowl, giant turtles emerge like monsters from the sea's white foam to lay eggs in the warm sand.

Four species of sea turtles nest on Meru-Betiri's beaches. The green is by far the most common, but leatherbacks, olive ridleys, and hawksbills also make occasional appearances. All of these

turtles are endangered and Sukamade Beach is the most important sea turtle nesting site left in Java. Nesting sea turtles, in turn, are Sukamade's and Meru-Betiri's greatest natural attraction. It is possible in just a few hours to watch, as we did, three female green turtles perform their timeless nesting ritual, and a hatchling emerge to find its way back to the sea—an experience possible in only a few other places anywhere.

The spectacle of a 150-kilogram turtle surfacing as a skyscraping wave recedes is truly awesome. That she makes it through the crashing surf is almost as amazing as the fact that she might have been to Australia, across more than 1000 kilometers of open ocean, since she nested here perhaps four years earlier. She does make it though, crawling up and over the beach (with a speed surprising in such a large beast and one out of its natural element) to the dunes above the high-tide mark. At once she begins to dig a hole, her powerful feet sending up great sprays of sand and dirt in all directions. First she hollows out a body-sized shallow depression, then excavates a deep, narrow hole into which the eggs are actually deposited. Once satisfied with the cavity's dimensions, she backs into the depression to lay several dozen eggs. Then she reverses the process, carefully burying the eggs with the ex-

cavated sand before she re-crosses the beach and disappears into the sea, her maternal duties accomplished. Unless they are dug up and eaten by pigs or poachers, these eggs will hatch months later and the tiny hatchlings will dig their way out of the sand and make a beeline for the sea. Only about five centimeters long, they appear as unafraid of the roaring surf as their huge, meter-long mother. Should they survive the vicissitudes of the next several years at sea, the young females will return to Sukamade Beach to lay their eggs in the same sand.

Only with luck and time will a visitor get to see the pods of sperm whales that appear offshore or catch a glimpse of secretive muntjac or chevrotain. It might take months to add Meru-Betiri's nearly 200 species of birds to a lifelist. But, like the tiger's ghost, what cannot be easily seen in a short visit is as potent in the imagination as it is in the flesh. It is enough to know that leopards and civets and dholes and fishing cats and pythons and monitor lizards are there, somewhere, perhaps watching *you*.

Can This Wild Place Survive?

Meru-Betiri came to the world's attention and became a reserve in the early 1970s, when the last of Java's endemic tigers were found living there. In 1976, John surveyed the area and found evidence of four, maybe five tigers but not of rusa deer, the tiger's major prey. By 1980, these few tigers were gone, despite their legal protection from hunting and the reintroduction of rusa.

It is unlikely that any action could have halted and reversed the processes that led to the tiger's extinction. Meru-Betiri, and other reserves where tigers had lingered, had long since become islands in a sea of agriculture— islands too small to support tiger populations large enough to survive. At best, only about ten tigers could make a living in an area the size of Meru-Betiri, too few not to be severely impacted, even to the point of extinction, by the effects of inbreeding.

But insular populations are also subject to extinction due to what scien-



Now found nowhere else on Java, the endemic Rafflesia zollingeriana is pollinated by carrion flies and dispersed on the hooves of large mammals. (Photo by Alain Compost)



A sustainable future for Meru-Betiri and the half-million people who rely on its fragile ecosystem will require a careful balance of conservation and development. (Photo by John Seidensticker)

tists call stochastic processes—and insurance underwriters call acts of God. A severe drought or famine, a flood or volcanic eruption, or an epidemic disease from which the animals cannot escape because there is nowhere to go can wipe out an entire population. Such an event—an epidemic disease in the 1960s that decimated the rusa deer—may have sealed the fate of the Javan tiger even before inbreeding took its almost inevitable toll.

Saving the rest of Meru-Betiri's splendid flora and fauna depends, however, on the recognition that the loss of wilderness will cost people as

dearly as it has cost the tiger. People are the greatest threat to the integrity of the park ecosystem, which must somehow be protected both for and against them.

One hundred thousand people live within walking distance of Meru-Betiri National Park; several thousand more live within its very boundaries, most of them on the two plantations that are still in operation there, a few in small scattered settlements. The plantations occupy alluvial valley bottoms that were once prime wildlife habitat and break up what would otherwise be a large contiguous expanse of natural for-

est; they also provide jobs. (It is ironic that the Sukamade plantation also provided gracious hospitality to park visitors. Indeed, its guesthouse is at present the only place to find bed and board. To sit on the porch, surrounded by dripping rainforest, sipping a beer and watching hornbills soar overhead may be as close to heaven as some of us ever get.)

The impact of plantations, which are slated eventually to be closed, and its workers, who are forbidden to hunt or gather in the forest, is relatively minor, however, compared to the impact of the people living around the park, who

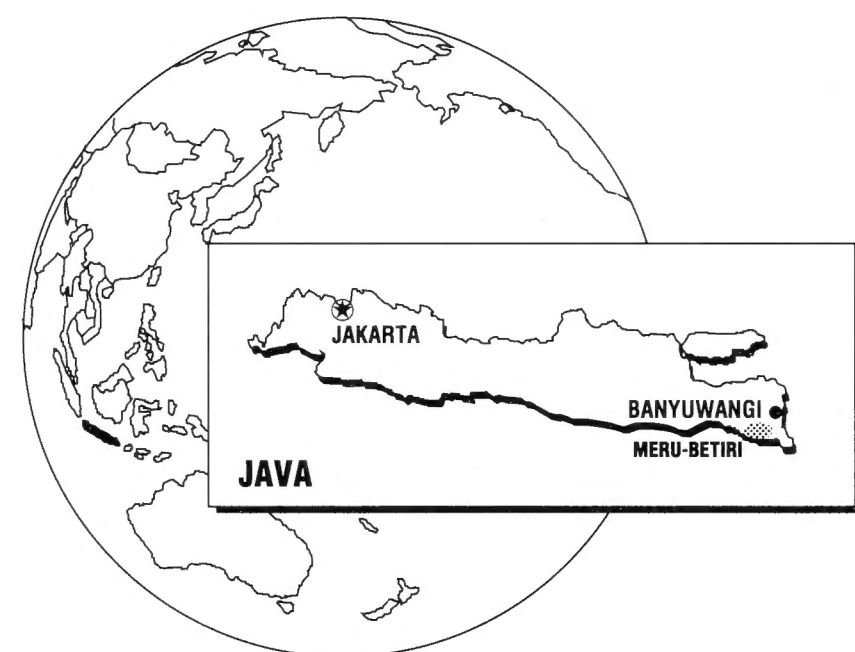
do hunt and gather there. According to a 1982 World Wildlife Fund report, the most significant threat is the "harvest of forest products. This is occurring on a scale which, if allowed to continue, will eventually eliminate or irreparably damage large areas of Meru-Betiri's forests."

Bamboo, rattan, timber, firewood, and medicinal plants including *Rafflesia*, are all taken from the forest in alarming amounts. Some of the harvest is commercial, in response to market demands for these increasingly scarce forest resources. But much of it goes to meet the basic human needs of the local people who must have firewood to cook their rice, bamboo poles to build their homes, and herbal remedies to cure their ills—necessities forests have always provided for people. To deny people access to the park's forest threat-

ens their lives and livelihoods. Why, they ask, are a few tigers or turtles more important than they are?

In fact, they are not. Meru-Betiri has extraordinary aesthetic value; it is a unique, beautiful, wild place worth preserving for this reason alone. Beauty, however, fills the spirit and not the stomach, and it is to fill stomachs that Meru-Betiri must be saved. The remaining forests play a vital role in protecting the watershed that maintains the agricultural productivity of the entire surrounding region. The economy and welfare of more than 500,000 people are thus critically linked to the forest and dependent on its preservation.

Since John's last visit in 1978, there are encouraging signs that Meru-Betiri will survive as a wild place—for people and for wildlife. Its status has been upgraded from game reserve to national



park and Meru-Betiri's managers and guards have become increasingly more effective in reducing the exploitation of the park's resources. Until 1979 nearly all the sea turtle eggs laid at Sukamade Beach were collected and sold; now no eggs are taken and the number of turtles nesting on the beach is increasing. Fewer people are illegally taking forest products, and a park infrastructure has been developed—offices, guard posts, and a visitor's center—to make tangible the park's existence. And a small but growing number of tourists, who pay for food, lodging, and other services, will begin to generate employment and enhance the perception of the park as a positive feature in the local economy. Plans to develop "buffer zones" around the park in which forest products are planted and harvested on a sustainable basis should eventually eliminate dependence on the natural forest. Indeed, human needs must be satisfied from some other source, either now, or later, when the natural forest is gone.

Neither the problems nor their solutions are unique to Meru-Betiri or to Indonesia. All over the world, the continued existence of wild places is threatened by a burgeoning human population; the essential linkage between conservation and economic development is clear to the vast majority of conservationists and is becoming increasingly clear to development planners. The ghosts of the tigers that haunt Meru-Betiri are compelling reminders of the costs of preserving too little wilderness, too late for wildlife. □

As is the case throughout much of the developing world, Indonesia's wild areas are being lost to cultivation to feed a burgeoning population. (Photo by John Seidensticker)



Culture and Conservation

Jeffrey A. McNeely

The Mentawai Islands loom 60 miles off the west coast of Sumatra, separated from the mainland by a deep strait that has kept the islands isolated for half a million years. As a result, these islands followed their own evolutionary path and developed one of the world's most interesting assemblages of animals, as well as a fascinating human culture.

In an area a bit smaller than Florida's Everglades National Park, the Mentawai Islands are inhabited by four species of primates that are found nowhere else; no other islands this size have *any* endemic primates. These primates include the only gibbons found on small islands; a leaf monkey that is the Eastern Hemisphere's only monogamous monkey; and a pig-tailed leaf monkey so strange that taxonomists place it in a genus all its own (its closest relative is the proboscis monkey on Borneo, which lies 600 miles to the east).

Being well off the ancient trade routes up and down the straits of Malacca, the Mentawai were ignored by the successive invasions of Indonesia by Hindus, Buddhists, Muslims, and Christians over the last 2,000 years. Until 100 years ago, the islands had neither chiefs, villages, pottery, metal, rice, nor tobacco, betel nut, or alcoholic drinks—the residents finding their earthly pleasures in a productive relationship with the spirits they believed inhabited all living things. Many of the people still worship spirits and have a close relationship with the animals they hunt. I was to learn that the close relationship between monkeys and people in this remote corner of the Indian Ocean holds lessons relevant to much of the tropical world.

The Mentawai are hunters of primates, needing the protein from their arboreal cousins to supplement a diet largely consisting of bananas and flour made from sago palms. Among the most archaic of Indonesians, the Mentawai hunt, with bow and poisoned arrows, after a series of ceremonies that ensure they do not over-exploit the resource. For example, monkeys are hunted only after the spirits have been consulted, and a hunter expects to be successful only if he avoids certain behavior—such as sleeping with his wife the night before the hunt. Extraordinary measures are required for gibbons, whose noisy territorial behavior makes them easy to hunt. Therefore, hunting gibbons is strictly forbidden by customary law, except in time of famine or dire need. Gibbons thus serve as an emergency source of food, one that is available only if it is conserved.

I had been asked to advise the Indonesian government on how to conserve these primates. But it quickly became clear that the local people were as interested in conserving the primates as I was. The monkeys were threatened not by hunting, but rather by forestry operations owned by wealthy Javanese and run by concession holders from distant lands. Few of the benefits of forestry flowed to the local people, although they were shouldering the environmental costs. On the other hand, conservation built on the culture of the local people would be inexpensive, relatively easy to implement, and beneficial to the Mentawaians.

As I have traveled on conservation missions throughout the tropics, I have seen this point demonstrated again and again: Local people care about conserving the resources they depend on and become exploiters only under pressure from outside. It should come as no surprise that indigenous people know their business—they have been surviving for thousands of years by harvesting their wildlife on a

sustainable basis. Their cultures—unlike ours—have stood the test of time.

In today's modern world, economic growth and global trade have stimulated forces that are exploiting even the forests of the Mentawai Islands. People are no longer dependent on locally available resources. Instead they are able to harvest logs, for example, from thousands of miles away, and ignore the environmental costs of such exploitation.

Global trade has led to great prosperity for those who have been able to benefit from the expanded productivity, but it has also led to the devastation of local ecosystems, as well as the plants, animals, and people dependent on those ecosystems. The traditional knowledge held by local people is disappearing as fast as their resources, to the detriment of the long-term productivity of tropical forests. Growing interaction with the larger world is increasing the vulnerability of isolated groups like the Mentawaians because they are often left out of the processes of economic development and are subject to exploitation. Many groups become dispossessed and marginalized, and their traditional practices disappear. Becoming the victims of what could be described as cultural extinction, they no longer have a vested interest in conserving their wildlife.

This is not a trivial problem. Indigenous people who live in intimate contact with their major resources could make important contributions to both conservation and sustainable development. The challenge is to apply their knowledge and, where appropriate, to transfer their techniques and thinking to conservation management systems that fit today's circumstances.

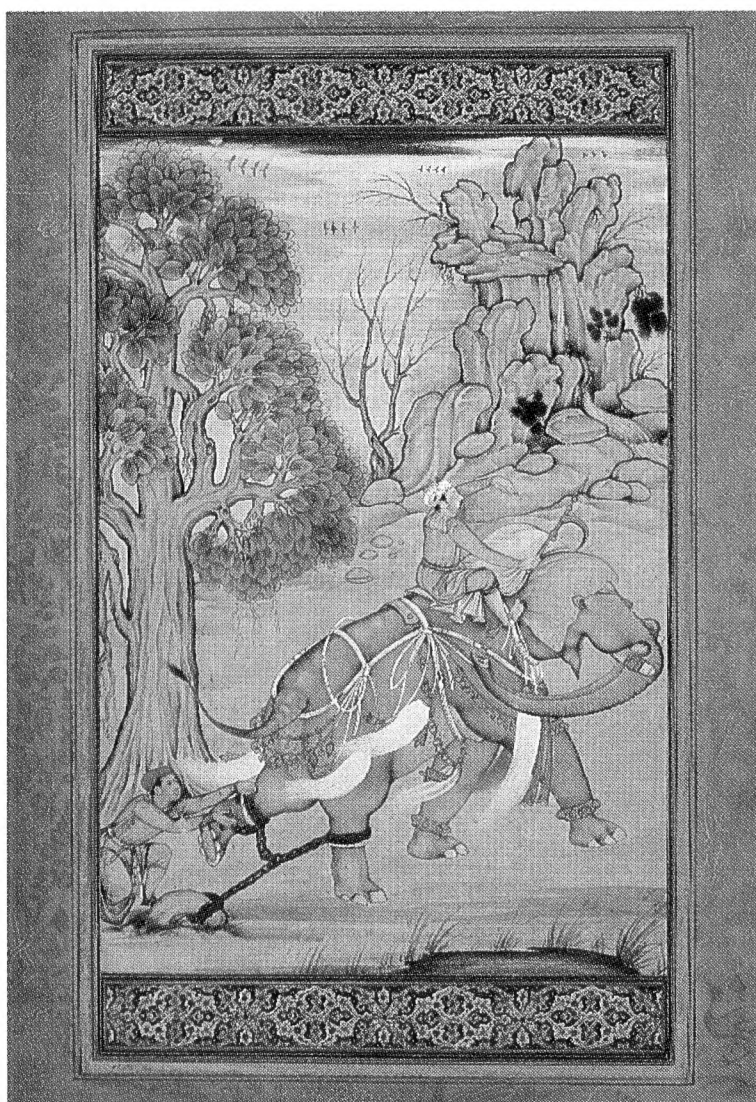
We should all be seriously concerned about maintaining human cultural diversity, well aware that part of the richness of human life around the globe is due to the inter-relationships between people and their local environments. The


extinction of cultures, or of traditional knowledge within cultures undergoing rapid change, is a problem at least as serious for humanity as the extinction of species. All who follow will share the loss of knowledge about the local environment. Crucial information about how it might be used to provide sustainable benefits may be lost forever, along with the species that have supported hunters for thousands of years.

In cooperation with traditional peoples and with the help of their knowledge of ecosystems, species, and sustainable resource use, we must seek new opportunities for achieving sustainable development. Our consumer culture will not last forever, but the earth abides. The numerous local cultures adapted to sustainable use of locally available resources may well provide the resilience that enables our species to adapt to whatever changes the future may bring. □

Mr. McNeely is Deputy Director General of the I.U.C.N. His latest book, Soul of the Tiger (Doubleday, 1988), written with Paul Wachtel, explores the relationship between people and animals in Southeast Asia. He recently participated in the NZP's symposium, "Culture: The Missing Element in Conservation and Development."

Above: A Chained Elephant. (56.12 Indian Painting: Mughal Leaf from "Jahangir Album." Courtesy of the Freer Gallery of Art, Smithsonian Institution, Washington, D.C.)





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